INDEX

TO

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INTRODUCTION

This index of the TRANSACTIONS consists of two separate parts, each intended for a distinct purpose.

First. There is an index of papers in which they are classified in natural groups and arranged chronologically in each group.

Second. There is an index of specific data and information arranged alphabetically.

The index of papers is intended for searchers desiring to locate papers on a given subject, and to aid in this search the papers have been characterized. These characterizations are not intended to be abstracts of the papers, but rather to give the scope and nature of their contents. The titles of many papers are misleading, and it is hoped thus to call the searcher's attention to the real nature of the contents, thus saving him much time in looking up useless references.

The index of specific data and information is intended for searchers desiring to make a complete study of the subject as presented in the TRANSACTIONS. There is a great mass of valuable information hidden in discussions which has no very direct connection with the subject of the paper. This data can be found only by reference to such a topical index.

Methods of classification of engineering information are as numerous as the people who have studied the subject. A logically arranged classification for this index seemed impossible. Accordingly all information was grouped into natural classes and very complete cross indexing was provided. The searcher will thus be lead to the desired information whatever may be his ideas of a proper arrangement.

The classification of the papers was determined by sorting them for the entire period covered by the index. Any group containing a large number of papers was subdivided. All papers were arranged chronologically to enable the searcher to pass over the early papers that might be too old for his use.

Naturally, many papers, especially when considered together with their discussions, fell into a number of different groups. In all such cases they were put into as many places as it was thought they might possibly belong If there was any doubt one way or the other, a paper was always put in.

There is no harm in having a paper under a heading where someone thinks it should not be, so long as it is also under the heading where that person thinks it ought to be. For instance, many high-tension systems ordinarily considered transmission lines, are to all intents and purposes distribution systems. In the future they will undoubtedly be considered such, as we now consider as distribution systems those which some years ago we looked upon as transmission lines. Accordingly, papers dealing with high-tension distribution systems are listed both under transmission and distribution.

The topical index is not a classified index in the ordinary sense. However, all of the information is properly grouped in an alphabetical manner. The conditions it was intended to carry out were as follows:

1. To index all useful specific data and information contained in the TRANSACTIONS.

2. To arrange the index items in such a manner that anybody could find them with a minimum of trouble.

In the attempt to meet these conditions the following general rules were observed:

1. All subjects are indexed under the noun, and where an adjective is practically inseparably associated with a noun by usage, it has been incorporated with it by a hyphen.

2. All references to a given subject are listed in the same place, so that having found one reference the searcher can rest assured that he has found all.

3. Apparatus and phenomena known by several names are grouped under one name and the other names inserted in the index with cross references. For instance, inductance coils, reactance coils, reactive coils, choke coils, reactors will all be found in the index with cross references to Reactors.

4. Apparatus and phenomena common to two or more subjects are grouped by themselves and cross references inserted under the related subjects. Thus, commutation is indexed by itself with cross references under generators, d. c.; motors, a. c.; motors, d. c.

5. Apparatus and phenomena of sufficient importance in themselves are indexed alone with cross references under the main heads of which they form a sub-division. Thus, catenary construction is indexed under catenary construction with cross reference under distribution, railway.

6. All properties of materials and apparatus are indexed under the name of the material or apparatus, except where the references are to the characteristics of the properties themselves. Therefore, a searcher will find under the name of a material all the properties of that material given in the TRANSACTIONS.

7. No distinction is made between singular and plural in arrangement of the items.

An attempt has thus been made to make it impossible for a searcher not to find all the information which is contained in the TRANSACTIONS. Actual use of the index can alone determine the success or failure of this undertaking. But, however unsuccessful in this particular, it is believed that this index will greatly increase the value of the TRANSACTIONS.

1. EDUCATION

ELECTRO-TECHNICAL EDUCATION

R. B. Owens Vol. ix—1892, pp. 462-475

Outline of educational requirements of electrical engineers, followed by description of course given at the University of Nebraska.

Discussion, incorporated with that of paper by D. C. Jackson on "The Technical Education of the Electrical Engineer."

THE TECHNICAL EDUCATION OF THE ELECTRICAL ENGINEER

Dugald C. Jackson Vol. ix—1892, pp. 476-486

Description of electrical engineering course of University of Wisconsin.

Discussion (including that of paper by R. B. Owens on "Electro-Technical Education"), pp. 486-499, by Messrs. Frank J. Sprague, F. B. Crocker, Thomas D. Lockwood, C. E. Emery, Prof. Roberts, F. R. Upton, N. W. Perry, C. S. Bradley and D. C. Jackson.

General remarks on electrical engineering education.

THE EDUCATION OF ELECTRICAL APPRENTICES AND JOURNEYMEN

Arthur A. Hamerschlag Vol. xv—1898, pp. 721-728

Discussion of problem of providing skilled labor for the electrical industry.

Discussion, pp. 729-736, by Messrs. J. W. Lieb, Jr., Joseph Wetzler, E. P. Thompson, A. A. Hamerschlag and R. W. Pope.

2. GENERAL THEORY

AN EXPERIMENTAL METHOD OF STUDYING THE DYNAMO MACHINE

C. F. Brackett — **Vol. i—1884, pp. 1-3, paper No. 7**

Description of a method of exploring the magnetic field of an experimental generator, designed to show the effect of iron in the armature core and that of current in the armature winding.

Discussion, pp. 3-4, by Messrs. N. S. Keith, C. F. Brackett, and E. A. Sperry.

CHEMISTRY OF THE CARBON FILAMENT

Edw. P. Thompson — **Vol. i—1884, pp. 1-11, paper No. 10**

Brief description of the chemistry of carbon filament manufacture and short description of the Swan, Stanley, Thompson and Weston processes of carbon filament manufacture.

Discussion, pp. 11-13, by Messrs. W. D. Sargent, Wm. H. Preece, N. S. Keith, John Kelly, and Chas. Stagl.

ON THE DIFFERING TEMPERATURE COEFFICIENTS OF THE DIFFERENT COILS OF A FINE RHEOSTAT

W. A. Anthony — **Vol. iv—1887, pp. 137-140**

Account of resistance variations in precision rheostat due to temperature, and suggestions for design of rheostat so as to reduce such errors to a minimum.

Discussion, pp. 140-148, by Messrs. ——— Wallace, W. A. Anthony, Frank L. Pope, Geo. B. Prescott, Jr., S. S. Wheeler, C. O. Mailloux, T. C. Martin, J. A. Powers, O. E. Michaelis, Geo. A. Hamilton, and Elihu Thomson.

Brief reference to Weston's experiments on German silver. Effect of winding strains on resistance of wire.

NOVEL PHENOMENA OF ALTERNATING CURRENTS

Elihu Thomson — **Vol. iv—1887, pp. 160-173**

Experimental investigation of repulsive action between changing magnetic field and electric conductor, developing principles which are applied to the operation of alternating current motors (repulsion motors).

Discussion, pp. 174-183, by Messrs. S. S. Wheeler, C. O. Mailloux, Geo. B. Prescott, Jr., Elihu Thomson, J. M. Pendelton, Carl Herring and J. A. Powers.

General remarks on electric repulsion; its use in electric measuring instruments.

ON THE CHANGE FROM NEGATIVE TO POSITIVE OF THE TEMPERATURE COEFFICIENT OF SOME CARBON FILAMENTS

W. A. Anthony — **Vol. iv—1887, pp. 198-199**

Brief reference to some experiments which indicate a change of sign of the coefficient of resistivity of carbon filaments.

Discussion, pp. 199-200, by Elihu Thomson.

Observations which tend to substantiate Professor Anthony's conclusion.

PHENOMENA OF RETARDATION IN THE INDUCTION COIL

William Stanley, Jr. Vol. v—1888, pp. 97-108

Discussion of alternating current phenomena, comparison of efficiency and losses in alternating current and direct current generators; explaining the mode of operation of transformers, action of induction coil in series with arc lamps.

Discussion, pp. 108-134, by Messrs. Townsend Wolcott, William Stanley, Jr., Herbert Howson, S. S. Wheeler, P. H. Vander Weyde, George B. Prescott, Jr., C. O. Mailloux, E. W. Rice, Jr., T. C. Martin, Jos. Wetzler and J. W. Howell.

General remarks on the operation of alternating current apparatus. Reference to hysteresis. Description of auto-transformer. Difficulties experienced in parallel operation of alternating current generators. Mode of operation of synchronous motors.

ELECTRIC ENERGY FROM CARBON WITHOUT HEAT

Willard E. Case Vol. v—1888, pp. 195-200

Account of experiment with primary cell with graphite positive electrode.

Discussion, pp. 201-210, by Messrs. C. O. Mailloux, Townsend Wolcott, Jos. Wetzler, F. B. Crocker, C. S. Bradley, ——— Grimshaw, and Willard E. Case.

Method of calculating theoretical e. m. f. of any primary cell.

IMPOSSIBILITIES AND LIMITATIONS OF CHEMICAL GENERATORS OF ELECTRICITY

Francis B. Crocker Vol. v—1888, pp. 277-288

Description of method of calculating e. m. f. with large number of actual calculations compared with the observed values. Results of tests of e. m. f. of different metals, with free chlorine, bromine, and iodine in different electrolytes. Technical data on cells with zinc as electro-positive material and various depolarizers and electro-negative materials. Discussion of the efficiency and opportunities for improvement of chemical generators.

Discussion, pp. 288-294, by Messrs. Otto A. Moses, F. B. Crocker, P. H. Vander Weyde, Edw. L. Nichols, C. O. Mailloux and Elihu Thomson.

General remarks on the chemical generation of electric energy.

LIGHTNING ARRESTERS AND THE PHOTOGRAPHIC STUDY OF SELF-INDUCTION

E. G. Acheson Vol. vi—1889, pp. 74-98

Experimental study of the effect of discharge of spark gap lightning arresters upon insulation stresses. Investigation of the effects of various arrangements of ground connection. Photographic records of spark dischargers under various circuit conditions exposed through revolving perforated disk.

Discussion, pp. 98-106, by Messrs. Otto A. Moses, E. G. Acheson, E. T.

Birdsall, Leonard le C. Hamilton, Lemuel W. Serrell, Joseph Wetzler, William E. Geyer, Charles Cuttriss, Allan V. Garratt and Holbrook Cushman.

LIGHTNING ARRESTERS AND THE PHOTOGRAPHIC STUDY OF SELF-INDUCTION

Joseph Stanford Brown and Charles T. Child **Vol. vi—1889, pp. 135-143**

Detailed analysis and criticism of Mr. Acheson's paper. Circuit diagram redrawn to bring out more clearly the electrical relations. Consideration of the condenser action of the cable upon the spark gap arrester performance.

Discussion, pp. 143-155, by Messrs. J. S. Brown, C. O. Mailloux, Ralph W. Pope and ——— Abdank.

Replies to criticisms of Mr. Acheson's paper.

MAGNETISM IN ITS RELATION TO INDUCED ELECTROMOTIVE FORCE AND CURRENT

Elihu Thomson **Vol. vi—1889, pp. 269-286**

Theoretical analysis of electro-magnetic induction phenomena in conductors, induction coils, transformers and dynamo machinery, showing the effect of form and nature of electric and magnetic circuit as well as density and speed of cutting magnetism.

Discussion, pp. 286-292, by Messrs. M. M. Garver, Elihu Thomson, Otto A. Moses, Joseph Wetzler, C. O. Mailloux, J. P. Wintringham, Louis Ducan, George H. Stockbridge and Edward Weston.

ON MODERN VIEWS WITH RESPECT TO ELECTRIC CURRENTS

Henry A. Rowland **Vol. vi—1889, pp. 342-357**

Brief review of experiments that establish the existence of electromagnetic waves. Description of Hertz's wave detector. Skin effect upon the wave front of electricity traversing a conductor.

No discussion.

A REVIEW OF MODERN ELECTRICAL THEORIES

William A. Anthony **Vol. vii—1890, pp. 33-42**

Outline of working hypothesis of space filled with wheels which are set in motion by flow of electricity. Reference to Hertz's work in proving existence of electromagnetic waves. Possibility of selective radiation in producing cold light.

Discussion, pp. 42-54, by Messrs. Otto A. Moses, W. K. Anthony, M. M. Garver, A. E. Kennelly, Townsend Wolcott, Michael Pupin, Nikola Tesla, and F. B. Crocker.

General remarks on Maxwell's and Faraday's theories of electricity. Distinction between difference of potential and e. m. f.

PHENOMENA OF ALTERNATING CURRENT INDUCTION

Elihu Thomsom Vol. vii—1890, pp. 132-150

Experimental lecture on electromagnetic induction phenomena, demonstrating repulsive forces due to secondary currents and time-lag of magnetism. Numerous experiments since become classic are illustrated.

No discussion.

PRACTICAL ASPECTS OF THE ALTERNATING CURRENT THEORY

M. I. Pupin Vol. vii—1890, pp. 204-217

Brief résumé of the development of fundamental laws of electricity, giving the discoveries of the laws and the date of discovery. Mathematical consideration of the ideal transformer.

Discussion, p. 287, by Messrs. O. T. Crosby, M. I. Pupin and Elihu Thomson.

A NEW METHOD OF ANALYZING ARMATURE REACTIONS OF ALTERNATORS

Charles P. Steinmetz Vol. vii—1890, pp. 434-438

Development of equation for calculation of effect of armature reaction upon the e. m. f. of constant potential and upon the current of constant-current alternators.

Discussion, pp. 439-445, by Messrs. Thorburn Reid and Charles P. Steinmetz.

REPORT OF THE COMMITTEE ON THE VALUE OF THE "HENRY"

Vol. viii—1891, pp. 31-56

Discussion of report and of Kennelly's paper on "Inductance and Its Proposed Unit 'Henry'," by Messrs. Frank B. Crocker, Cary T. Hutchinson, Geo. A. Hamilton, Thorburn Reid, A. E. Kennelly, C. O. Mailloux, Chas. P. Steinmetz, W. A. Anthony, Ralph Pope and S. S. Wheeler.

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A PHOTOGRAPHIC STUDY OF THE ELECTRIC ARC

Edward L. Nichols Vol. viii—1891, pp. 214-221

Account of experiments that show the intermittent character of alternating current arc and explaining the cause of surging. Measuring wave form and photographs of arc observed, with revolving mirror under various conditions.

Discussion, pp. 222-226, by Messrs. Elihu Thomson, Edward L. Nichols, Carl Hering, C. O. Mailloux and Thos. D. Lockwood.

Explanation of cause of wave distortion by arc. Beginning of custom of presenting the Institute with portraits of past Presidents.

EXPERIMENTS WITH ALTERNATE CURRENTS OF VERY HIGH FREQUENCY AND THEIR APPLICATION TO METHODS OF ARTIFICIAL ILLUMINATION

Nikola Tesla Vol. viii—1891, pp. 267-319

General discourse on the nature of electricity. Notes on the design and construction of very high frequency generators. Account of experiments with very high frequency and high potential currents, demonstrating the character of discharges through air as affected by electrodes, frequency, potential and various other conditions. Proposal to produce electrostatically incandescent illumination that has the same efficiency and the same economical characteristics of the usual incandescent lamp. The different types of discharge, the lamps and generator are fully illustrated.

No discussion.

MAGNETIC RELUCTANCE

A. E. Kennelly Vol. viii-1891, pp. 485-51

Account of the development of the theory of magnetism, the polar, the vein and the circuit theories. Review of experiments made by Rowland, Ewing, Low and others. Typical magnetization curves for different grades of iron and steel and of nickel and cobalt at different temperatures. Reference to original articles and full data tabulated for all curves.

Discussion, pp. 518-532, by Messrs. A. E. Kennelly, Carl Herring, J. Stanford Brown, Louis Bell, Chas. E. Emery, M. I. Pupin, Charles P. Steinmetz and Thos. D. Lockwood.

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ON THE LAW OF HYSTERESIS

Charles P. Steinmetz Vol. ix—1892, pp. 3-51

Account of experimental investigation of magnetic hysteresis. Description of apparatus used and results of tests on different types of magnetic circuits and different qualities of material. Hysteretic constants for various classes of iron and steel.

Discussion, pp. 51-60, by Messrs. Thomas D. Lockwood, C. P. Steinmetz, Charles S. Bradley, Joseph Wetzler, A. E. Kennelly and M. I. Pupin.

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A. E. Dolbear Vol. ix—1892, pp. 95-97

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Louis Duncan Vol. ix—1892, pp. 179-190

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Charles E. Emery Vol. ix—1892, pp. 192-222

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DERIVATION AND DISCUSSION OF THE GENERAL SOLUTION FOR THE CURRENT FLOWING IN A CIRCUIT CONTAINING RESISTANCE, SELF-INDUCTION AND CAPACITY, WITH ANY IMPRESSED ELECTROMOTIVE FORCE

Frederick Bedell and Albert C. Crehore Vol. ix—1892, pp. 303-374

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THE REVERSAL OF POLARITY IN PLATING DYNAMOS

Harris J. Ryan Vol. ix—1892, pp. 525-526

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Charles P. Steinmetz Vol. ix—1892, pp. 621-724

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A. E. Kennelly Vol. x—1893, pp. 175-216

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C. P. Matthews **Vol. x—1893, pp. 251-265**

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M. I. Pupin **Vol. x—1893, pp. 370-394**

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M. I. Pupin **Vol. xi—1894, pp. 523-550**

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A. M. Bleile. Vol. xii—1895, pp. 390-396

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Charles E. Emery Vol. xii—1895, pp. 433-453

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Charles K. Huguet Vol. xiii–1896, pp. 207-216

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M. I. Pupin Vol. xvi—1899, pp. 93-142

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3. MEASUREMENTS AND INSTRUMENTS

A. UNITS AND STANDARDS

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William A. Anthony **Vol. iii—1886, pp. 67-69**

Description of the instrument, its degree of accuracy and advantages over other absolute methods of measurement.

Discussion, pp. 70-73, by Messrs. Frank L. Pope, ——— Lain, C. O. Mailloux, ———Young, Ralph W. Pope, and Thos. D. Lockwood.

Further details of the construction of the great tangent galvanometer. Objections to the voltmeter.

ON COMPENSATED RESISTANCE STANDARDS

Edw. L. Nichols **Vol. v—1888, pp. 295-304**

Description of a compensated carbon-copper shunt, with an approximately zero temperature coefficient of resistivity. Table of temperature coefficients of various forms of carbon observed by different investigators.

Discussion, p. 304, by Messrs. S. S. Wheeler, Edw. L. Nichols and Otto A. Moses.

A SWINGING ARM GALVANOMETER

George S. Moler **Vol. v—1888, pp. 345-350**

Description of a moving needle galvanometer with a current coil arranged to swing in a vertical quadrant, so as to increase the current of range. Calibration curve of a certain instrument.

THE SPIRAL COIL VOLTAMETER

Harris J. Ryan **Vol. vi—1889, pp. 322-329**

Description of construction, operation and calibration of spiral coil electrode copper voltameter.

Discussion, pp. 329-334, by Messrs. Edward Weston, Elihu Thomson, C. O. Mailloux, Otto A. Moses, E. T. Birdsall and E. L. Nichols.

Reasons for unreliability of copper voltameters. Pertinent remarks on electro-plating that bear on the construction of voltameters.

PRELIMINARY REPORT OF THE STANDARD WIRING TABLE COMMITTEE

Vol. vii—1890, pp. 344-365

Standard conductivity based on Matthiessen's correct standard. Discussion of Matthiessen's standard. Resolution for the adoption of the henry as a unit of inductance.

INDUCTANCE AND ITS PROPOSED UNIT THE "HENRY"

A. E. Kennelly **Vol. viii—1891, pp. 1-18**

Definition of inductance. Proposed practical unit of inductance and reasons for its adoption. Definition of time constant. Analogies between inductance and capacity. Methods of measuring inductance.

Discussion, incorporated with that of Committee's report on the proper value of the "Henry."

REPORT OF THE COMMITTEE ON THE VALUE OF THE "HENRY"

Vol. viii - 1891, pp. 31-56

Discussion of report and of Kennelly's paper on "Inductance and Its Proposed Unit 'Henry'," by Messrs. Frank B. Crocker, Cary T. Hutchinson, Geo. A. Hamilton, Thorburn Reid, A. E. Kennelly, C. O. Mailloux, Chas. P. Steinmetz, W. A. Anthony, Ralph Pope and S. S. Wheeler. Definitions of inductance. Physical significance of inductance.

AN ALTERNATE CURRENT POTENTIOMETER

Geo. S. Moler Vol. viii - 1891, pp. 324-326

Discussion of an instrument in which mean effective alternating current is adjusted to equal the given direct current by changing the brilliancy of the incandescent filament. Test of accuracy.

Discussion, pp. 327-330, by Messrs. G. W. Blodgett, Edward L. Nichols, Elihu Thomson, Edward Weston, George Forbes and John Waring.

Experience as to sensitiveness of eye to slight variation in brilliancy of incandescent filament.

REPORT OF COMMITTEE ON UNITS AND STANDARDS

Vol. viii -1891, pp. 533-534

List of new units practically needed for convenience in dealing with magnetic circuits.

Discussion, pp. 535-543, by Messrs. Carl Hering, C. O. Mailloux, Thos. D. Lockwood, A. E. Kennelly, Townsend Wolcott, W. A. Anthony, J. Stanford Brown, M. I. Pupin, Chas. P. Steinmetz and Francis B. Crocker.

RELATION BETWEEN THE ELECTROMOTIVE FORCE OF A CLARK CELL AND THE DENSITY OF THE ZINC SULPHATE SOLUTION

H. S. Carhart Vol. ix—1892, pp. 614-617

Results of experimental investigation of the Clark cell, determining the temperature coefficient of resistance.

Discussion, p. 617, by Messrs. Thomas D. Lockwood and E. G. Willyoung.

A MODIFIED DEPREZ-D'ARSONVAL GALVANOMETER

Charles D. Parkhurst Vol. x - 1893, pp. 270-286

Detailed description of modified form of D'Arsonval galvanometer using pivoted coil and mirror. Data that are necessary for substitution in the tangent galvanometer formula.

Discussion, pp. 287-296 and 489-490, by Messrs. Elmer G. Willyoung, Edward Weston, Louis Ducan, R. C. Carpenter and Charles D. Parkhurst.

Criticism of author's instrument. Discussion of the relative advantages of Aryton and Weston types of moving coils. Weights of movable system used in Weston portable d. c. instruments.

ON THE NOTATION PROPOSED BY M. HOSPITALIER

Alexander MacFarlane Vol. x—1893, pp. 427-429

REPORT OF COMMITTEE ON UNITS AND STANDARDS

Vol. xi—1894, pp. 48-52

Discussion, by Messrs. Townsend Wolcott, C. O. Mailloux, Charles P. Steinmetz, A. E. Kennelly and C. S. Bradley.

REPORT OF COMMITTEE ON UNITS AND STANDARDS

Vol. xi—1894, pp. 124-132

STANDARDIZING ELECTRICAL MEASURING INSTRUMENTS

Elmer G. Willyoung Vol. xi—1894, pp. 476-491

General description of the potentiometer and its advantages in standardization of commercial instruments. Detailed description of a self-contained special potentiometer designed by the author.

Discussion, pp. 492-501 and 783-786, by Messrs. R. O. Heinrich, J. G. Wray, S. A. Rhodes and W. M. Stine.

Account of investigation of different forms of the Clark standard cell, indicating the probable limits of accuracy of the potentiometer method of measurement. Advantages of the Weston standard direct reading instrument. Description of a Weston potentiometer for Rayleigh's compensation method. General remarks on the standardization of commercial instruments.

ON THE UNITS OF LIGHT AND RADIATION

A. Macfarlane Vol. xii—1895, pp. 3-8

Discussion of various light units proposed by different scientists and engineers. Definition of various units.

Discussion, pp. 8-17, by Messrs. A. E. Kennelly, Townsend Wolcott, Douglass Burnett, Clayton H. Sharp and W. M. Stine.

General remarks on lighting units.

REPORT ON PRIMARY AND SECONDARY PHOTOMETRIC STANDARD THE ACETYLENE AND PRIMARY STANDARDS

Vol. xii—1895, pp. 500-501

STANDARDS OF LIGHT

Preliminary Report of the Sub-Committee of the Institute

Edward L. Nichols, Clayton H. Sharp, and Charles P. Matthews Vol. xiii—1896, pp. 133-198

Account of the investigations of various standards of light, giving the relative merits and characteristics of the different types of lamps and candles.

Discussion, pp. 198-205, by Messrs. Louis Duncan, J. W. Howell, E. L. Nichols, Carl Hering, C. P. Steinmetz and R. A. Fessenden

REPORT OF COMMITTEE ON UNITS AND STANDARDS, RECOMMENDING THE ADOPTION OF THE HEFNER-ALTENECK LAMP AND THE LUMMER-BRODHUN PHOTOMETER SCREEN

Vol. xiv—1897, p. 90

THE PRECISION OF ELECTRICAL ENGINEERING

Presidential Address

F. B. Crocker Vol. xiv—1897, pp. 237-249

Part played by precision measurement and determination of electrical quantities in the development of electrical engineering.

A CAPILLARY ELECTROMETER FOR ELECTRICAL MEASUREMENTS

Charles F. Burgess Vol. xv—1898, pp. 337-346

Theory, construction and characteristics of capillary electrometer used in measuring insulation resistance and electromotive force.

No discussion.

B. ELECTRICAL MEASUREMENTS AND INSTRUMENTS

THE COULOMB-METER, OR INSTRUMENT FOR MEASURING THE CONSUMPTION OF ELECTRICITY

Geo. Forbes Vol. v—1888, pp. 33-39

Description of the construction of a coulomb-meter that utilizes the heating effect of the current, and can be used for either alternating current or direct current without change in calibration.

Discussion, pp. 40-63, by Messrs. Geo. Forbes, P. H. Vander Weyde, Frank L. Pope, C. O. Mailloux, S. S. Wheeler, Geo. D'Infreville, Henry Greer, Sidney F. Shelbourne, Jos. Wetzler, Elias E. Ries, Edward Weston, J. W. Howell and F. B. Crocker.

Further data on the Forbes coulomb-meter. Description of the Weston electro-magnetic mercury float coulomb-meter.

THE GEYER-BRISTOL METER FOR DIRECT AND ALTERNATING CURRENTS

William E. Geyer Vol. vi—1889, pp. 2-6

Description of recording ammeter or voltmeter, actuated by differential expansion of compound strip and rod heated by electric current.

Discussion, pp. 6-12, by Messrs. Alfred M. Mayer, S. S. Wheeler, William E. Geyer, Carl Hering, P. H. Vander Weyde, C. O. Mailloux, F. C. Crocker, Townsend Wolcott and Otto A. Moses.

SIX YEARS' PRACTICAL EXPERIENCE WITH THE EDISON CHEMICAL METER

W. J. Jenks Vol. vi—1889, pp. 26-57

Brief synopsis of early patents bearing on the Edison electro-chemical meter and its auxiliary appliances. Description of the construction, wiring and mode of operation of Edison meter. Analysis of errors and discussion of advantages. Review of successful achievements in practice.

Discussion, pp. 58-69, by Messrs. W. J. Jenks, C. S. Bradley, Ralph W.

Pope. Edward P. Roberts, S. S. Wheeler, F. B. Crocker, Elihu Thomson, Lewis F Lyne, J. W. Howell, F. R. Upton, E. T. Birdsall, C. L. Edgar, J. Stanford Brown and Charles Wirt.

General remarks on accuracy and cost of operation of Edison meter.

TRANSFORMERS

Harris J. Ryan **Vol. vii—1890, pp. 1-19**

Account of experimental investigation of the performance of a transformer, describing the methods and apparatus employed. Wave form of e. m. f.'s., load current and exciting current measured by point-by-point method. Efficiency and losses at different loads.

Discussion, pp. 19-29, by Messrs. Townsend Wolcott, H. J. Ryan, Nikola Tesla, A. E. Kennelly, William E Geyer, Joseph Wetzler, C. O. Mailloux, E. G. Acheson and L. B. Stillwell.

Varying opinions as to cause of distortion in the exciting current wave.

ELECTRIC METERS

George W. Walker **Vol. viii—1891, pp. 351-360**

Brief analytical discussion of the relative merits of Edison electrochemical meter, the Shallenberger induction watt-hour meter, the Aron ampere-hour meter, the Thomson commutator watt-hour meter and the Walker recording ammeter which photographically records the movements of the pointer of an ammeter. Statistics on early meter patents.

Discussion, pp. 361-374, by Messrs. Elihu Thomson, Geo. W. Walker, C. R. Van Trump, E. T. Birdsall, Edward Weston, C. O. Mailloux, W. A. Anthony and E. W. Rice, Jr.

Choice of suitable name for Thomson watthour meter. Criticisms of the Thomson and Walker meters.

NOTE ON SOME EXPERIMENTS WITH ALTERNATING CURRENTS

Louis Duncan **Vol. ix—1892, pp. 179-190**

Description of apparatus for simultaneous observation of several different wave forms by the contact method.

Discussion, pp. 190-191, by Messrs. Henry S. Carhart and Edward L. Nichols.

A DYNAMO INDICATOR, OR INSTANTANEOUS CURVE-WRITING VOLTMETER

George S. Moler **Vol. ix—1892, pp. 223-226**

Description af apparatus.

Discussion, pp. 227-228, by Messrs. F. B. Crocker, E. L. Nichols, Prof. ——— Roberts and C. E. Emery.

NOTES ON WIPING CONTACT METHODS FOR CURRENT AND POTENTIAL MEASUREMENTS

Benj. F. Thomas **Vol. ix—1892, pp. 263-268**

Description of contact method of measuring wave form by balancing potential against battery potential.

Discussion, pp. 269-270, by Messrs. E. L. Nichols, Charles F. Scott, D. C. Jackson and H. S. Carhart.

ELECTRICAL RECORDING METERS

Caryl D. Haskins **Vol. x—1893, pp. 29-47**

Brief description of the various types of meters used to measure electric service—ampere-hour meters, recording ammeters, recording wattmeters and watt-hour meters, covering chemical, recording chemical, clock work and motor meters. Shortcomings of induction meters and advantages of Thomson commutator type meter.

Discussion, pp. 48-62, by Messrs. W. D. Lockwood, Townsend Wolcott, C. D. Haskins, R. O. Heinrich, Fred W. Tischendoerfer, A. E. Kennelly, C. R. Van Trump and J. Overbury.

Description of the Teague meter and results of load tests showing losses. Accuracy of commercial watt-hour meters.

HEDGEHOG TRANSFORMER AND CONDENSERS

Frederick Bedell, K. B. Miller, and G. F. Wagner **Vol. x—1893, pp. 497-518**

Description of point-by-point method of measuring wave form by means of Bedell-Ryan revolving contact maker. Complete reference covering history of development of point-by-point method. Description of Hedgehog transformer and account of performance tests made with current and e. m. f. wave meters. Study of the effect of condensers on line current.

Discussion, pp. 519-527, by Messrs. A. E. Kennelly, M. I. Pupin, Charles E. Emery, Frederick Bedell and Charles P. Steinmetz.

General remarks on performance of ordinary Hedgehog transformer. Observed dielectric hysteresis loop.

AN OPTICAL PHASE INDICATOR AND SYNCHRONIZER

George S. Moler and Frederick Bedell **Vol. xi—1894, pp. 502-506**

Description of synchronism indicator.

No discussion.

A RELIABLE METHOD OF RECORDING VARIABLE CURRENT CURVES

Albert C. Crehore **Vol. xi—1894, pp. 507-521**

Description of current wave tracer based on rotation of plane of polarization of monochromatic light; theory and laws.

Discussion, pp. 521-522, by Messrs. C. P. Steinmetz and William A. Anthony.

A NEW METHOD OF STUDYING THE LIGHT OF ALTERNATING ARC LAMPS

William L. Puffer **Vol. xiii—1896, pp. 71-78**

Description of stroboscopic investigation of electric arcs.

No discussion.

AN EXPERIMENTAL STUDY OF ELECTRO-MOTIVE FORCES INDUCED ON BREAKING A CIRCUIT

F. J. A. McKittrick, with an introduction by Dr. Edward L. Nichols **Vol. xiii—1896, pp. 245-268**

Construction of high frequency galvanometer provided with mirror and photographic attachment. Description of test made with the apparatus. Reproductions of current and e. m. f. curves.

Discussion, pp. 268-269, by Messrs. W. A. Anthony, A. J. Wurts, E. L. Nichols and J. W. Howell.

ELECTRIC METERING FROM THE STATION STANDPOINT

Caryl D. Haskins **Vol. xiv—1897, pp. 317-326**

Discussion of qualities that a satisfactory watt-hour meter should possess. Importance of measuring constant energy output.

Discussion, pp. 326-334, by Messrs. Louis Bell, F. A. C. Perrine, R. B. Owens, C. D. Haskins, H. C. Spaulding, A. E. Childs and C. P. Steinmetz.

THE PHOTOMETRY OF THE ENCLOSED ALTERNATING ARC

Charles P. Matthews, W. H. Thompson and J. E. Hilbish **Vol. xv—1898, pp. 579-597**

Description of method of photometrying arc lamps. Distribution curves for enclosed alternating and direct current arcs with different kinds of glassware. Description of mechanical device for recording voltmeter settings.

Discussion, pp. 598-609, by Messrs. L. B. Marks, W. H. Friedman, A. E. Kennelly and John Millis.

General remarks on photometry of arc lamps.

THE DETERMINATION OF THE WAVE FORM OF ALTERNATING CURRENTS WITHOUT A CONTACT MAKER

Harris J. Ryan **Vol. xvi—1899, pp. 345-357**

Description of the theory, construction and method of operating an impulse transformer for measuring wave form. Complete design data.

Discussion, pp. 357-360, by Messrs. C. P. Steinmetz, Samuel Sheldon, C. A. Adams, H. J. Ryan and C. P. Matthews.

Contact makers for measurement of wave form.

C. NON-ELECTRICAL MEASUREMENTS

AN AUTOMATIC PRINTING SPEED-COUNTER FOR DYNAMO SHAFTING

Geo. S. Moler **Vol. x—1893, pp. 331-335**

Description of construction and mode of operation.

4. DIELECTRICS AND DIELECTRIC PHENOMENA

UNDERGROUND WIRES

William Callender Vol. i—1884, pp. 1-8, paper No. 3

Description of methods of applying Bitite (vulcanized bitumen) to the insulation of underground conductors as used in English built-in conduit systems.

Discussion, pp. 9-12, by Messrs. W. D. Sargent and Wm. H. Preece.

General remarks on the feasibility of operating underground circuits.

UNDERGROUND ELECTRICAL SYSTEMS

Sydney F. Shelbourne Vol. iii—1886, pp. 31-48

General discussion of the problems involved in the operation of the electric circuits underground. Description of the properties of various duct materials. Explanation of the relation between specific capacity and insulation quality. Discussion of the qualities of cable insulating materials. Account of troubles with corrosion of lead sheaths. Suggested methods of avoiding inductive disturbances on arc lighting cables and particularly telephone and telegraph lines.

Discussion, pp. 49-66, by Messrs. Frank L. Pope, W. D. Lockwood, T. D. Lockwood, C. O. Mailloux, G. C. Maynard, Sydney F. Shelbourne, ——— Young, Ralph W. Pope and O. E. Michaelis.

Experience with lead covered cables underground. Explanation of the corrosion of lead.

LEAD ENCASED CONDUCTORS

David Brooks Vol. iv—1887, pp. 201-205

References to early attempts to use lead covered conductors and troubles encountered in cable insulation. Fundamental discovery that made lead covered insulated conductors practicable. Advantages of lead covered cables.

No discussion.

OIL VERSUS AIR AS AN INSULATING MEDIUM

James B. Williams Vol. ix—1892, pp. 601-613

Account of qualitative experiments on the leakage resistance characteristics of different kinds of oil.

No discussion.

MICANITE, AND ITS APPLICATION TO ARMATURE INSULATION

Edward P. Thompson for Charles W. Jefferson and Arthur H. S. Dyer Vol. ix—1892, pp. 798-810

Brief reference to early methods of insulating armatures. Characteristics of mica and description of different commercial forms of magnetite used in the insulation of armatures and commutators.

Discussion, pp. 811-823, by Messrs. W. J. Hammer, W. A. Anthony, Carl Hering, Charles W. Jefferson, R. W. Pope, F. B. Crocker, E. P. Thomson, L. W. Kingsley, C. P. Steinmetz, J. B. Williams and A. E. Kennelly.

General remarks on the characteristics and testing of insulation.

NOTE ON THE DISRUPTIVE STRENGTH OF DIELECTRICS

Charles P. Steinmetz **Vol. x—1893, pp. 85-105**

Experimental investigation of the dielectric strength of various insulating materials as shown by curves plotted between sparking distance and e. m. f. Equation for striking e. m. f. of various materials.

Discussion, pp. 106-115, by Messrs. J. B. Williams, F. B. Crocker, Carl Hering, Alexander MacFarlane and Charles P. Steinmetz.

General remarks on dielectric strength tests. Results of tests by other investigators.

EFFECT OF TEMPERATURE ON INSULATING MATERIALS

George F. Sever, A. Monell and C. L. Perry **Vol. xiii—1896, pp. 223-230**

Description of test of the insulation resistance of various insulating materials at different temperatures. Results plotted as curves.

Discussion, pp. 230-243, by Messrs. C. P. Steinmetz, F. B. Crocker, C. F. Scott, C. L. Perry and A. E. Kennelly

Account of tests on effect of temperature on insulating materials. Relation of insulation resistance to dielectric strength.

THE EFFECT OF HEAT ON INSULATING MATERIALS

Putnam A. Bates and Walter C. Barnes **Vol. xiv—1897, pp. 253-263**

Description of test together with results with fiber insulation. The object being to discover the bearing of various surrounding conditions upon the result.

Discussion, pp. 264-273, by Messrs. F. B. Crocker, F. A. C. Perrine, Elihu Thomson, William Esty, J. H. Bates, C. P. Steinmetz and A. E. Kennelly.

Effect of moisture upon insulation.

INSULATION AND CONDUCTION

Reginald A. Fessenden **Vol. xv—1898, pp. 119-151**

Theory of the conduction of electricity in solids, liquids, and gases, Requirements of an insulating material. Dielectric properties of various types of insulating materials.

Discussion, pp. 151-160, by Messrs. F. B. Crocker, W. S. Franklin, M. I. Pupin and R. A. Fessenden.

General remarks on the theory of insulation and conduction.

DIELECTRIC STRENGTH OF AIR

Charles P. Steinmetz **Vol. xv—1898, pp. 281-326**

Description of an extensive experimental investigation of the dielectric strength of air under various conditions. Striking distances between various shaped electrodes. Calculation of the potential distribution between cylindrical electrodes.

Discussion, pp. 327-329 and 402, by Messrs. A. Vosmaer, Harold B. Smith and Charles P. Steinmetz.

High potential transformers for insulation testing.

HIGH-VOLTAGE POWER TRANSMISSION

Charles F. Scott **Vol. xv—1898, pp. 531-576**

Account of experience and tests made upon the high-tension system at Telluride. Experience covering insulators, corona loss, transformers and lightning protection. Results of Mershon's tests upon corona losses, together with extensive extracts from his report.

No discussion.

5. ELECTRIC CONDUCTORS

UNDERGROUND WIRES

William Callender — Vol. i—1884, pp. 1-8, paper No. 3

Description of methods of applying Bitite (vulcanized bitumen) to the insulation of underground conductors as used in English built-in conduit systems.

Discussion, pp. 9-12, by Messrs. W. D. Sargent and Wm. H. Preece.

General remarks on the feasibility of operating underground circuits.

EARTH WIRES; OR, THE EARTH AS AN ELECTRIC CIRCUIT COMPLETER

Thos. D. Lockwood — Vol. i—1884, pp. 1-8, paper No. 8

Account of earliest uses of earth as return conductor and the first application of the earth as common return in telegraph systems. Brief statement of electric conductor theories of earth return. Description of methods of making various kinds of ground connections in telegraph work.

REPORT OF COMMITTEE ON STANDARD WIRE GAUGE

Vol. iii—1886, pp. 144-157

After discussion, the adoption is postponed.

Report of the Committee on monthly meeting is adopted and steps taken to call a meeting the following month.

ON THE DIFFERING TEMPERATURE COEFFICIENTS OF THE DIFFERENT COILS OF A FINE RHEOSTAT

W. A. Anthony — Vol. iv—1887, pp. 137-140

Account of resistance variations in precision rheostat due to temperature, and suggestions for design of rheostat so as to reduce such errors to a minimum.

Discussion, pp. 140-148, by Messrs. ——— Wallace, W. A. Anthony, Frank L. Pope, Geo. B. Prescott, Jr., S. S. Wheeler, C. O. Mailloux, T. C. Martin, J. A. Powers, O. E. Michaelis, G. A. Hamilton and Elihu Thomson.

Brief reference to Weston's experiments on German silver.

Effect of winding strains on resistance of wire.

LEAD ENCASED CONDUCTORS

David Brooks — Vol. iv—1887, pp. 201-205

References to early attempts to use lead covered conductors and troubles encountered in cable insulation. Fundamental discovery that made lead covered insulated conductors practicable. Advantages of lead covered cables.

No discussion.

NOTE ON THE MOLECULAR MOVEMENTS IN A CONDUCTOR

A. E. Dolbear Vol. ix—1892, pp. 95-97

Experimental demonstration of rotation of molecules in conductor.

Discussion, pp. 97-100, by Messrs. C. O. Mailloux, Townsend Wolcott, A. E. Kennelly, M. I. Pupin, Harold Binney, F. B. Crocker, Carl Hering, Samuel Sheldon and Charles J. Kintner.

THE ACTION OF CONTINUOUS AND ALTERNATING CURRENTS ON FUSE METALS

C. P. Matthews Vol. x—1893, pp. 251-265

Development of Preece's law of fusing currents and résumé of some of his experiments giving constants for various materials. Experimental study of cooling effect of terminals, time element in fusing action and effects of alternating currents on fusing point of commercial fuses.

Discussion, pp. 266-269, by Messrs. E. J. Houston, C. P. Matthews, Elmer G. Willyoung, E. L. Nichols and Milton C. Canfield.

General remarks on fuse testing.

UNDERWRITERS' RULES

William A. Anthony Vol. xii—1895, pp. 170-173

Protest against resolution passed by New York Board of Fire Underwriters approving "Attix" tube.

Discussion, pp. 174-214, by Messrs. C. O. Mailloux, William J. Hammer, H. Ward Leonard, Franklin S. Holmes, James Hamblet, W. J. Jenks, James I. Ayer, C. J. H. Woodbury, Fremont Wilson, Clark C. Haskins, W. H. Merrill, Jr., Arthur Frantzen, L. Gutmann, B. J. Arnold, William L. Puffer A. E. Kennelly, W. A .Anthony and C. T. Hutchinson.

General remarks on electric code for fire underwriters. Account of experiments on current-carrying capacity of insulated wires under various conditions.

PROPERTIES OF FUSE METALS WHEN SUBJECTED TO SHORT CIRCUITS

Walter E. Harrington Vol. xii—1895, pp. 226-234

Experimental investigation of fusing currents for different metals under various conditions. Tables of fusing currents for copper, aluminium and lead and zinc composition metals. Preece's law and constants for various metals.

Discussion, pp. 234-244, by Messrs. Leonard Waldo, Charles P. Steinmetz, F. B. Crocker, C. J. Reed, W. A. Anthony, Elihu Thomson, Geo. W. Blodgett, Allan V. Garratt, Walter E.. Harrington, Carl Hering and Wm. Brophy.

Physical operation of fuses. Function of fuses.

THE RATING AND BEHAVIOR OF FUSE WIRES

W. M. Stine, H. E. Gaytes and C. E. Freeman Vol. xii—1895, pp. 546-564

Account of tests of fuse wire, showing the influence of material, dimensions, time, terminals, prolonged load, etc., upon the operation of the fuse.

Discussion, pp. 564-575, by Messrs. F. B. Crocker, C. E. Emery, A. E. Kennelly, Townsend Wolcott, R. T. Lozier, Wm. Stanley, J. W. Howell, A. V. Abbott, W. M. Stine and Ludwig Gutmann.

General remarks on the performance of fuses.

THE NATIONAL ELECTRICAL CODE

Vol. xiv—1897, pp. 489-511

Report on the National Electrical Code, p. 514.

Discussion, pp. 515-546, by Messrs. M. J. Hammer, Joseph Sachs, A. E. Kennelly, Gano S. Dunn, C. O. Mailloux, C. M. Goddard, Cary T. Hutchinson, Alex. Henderson, S. Dana Greene, F. B. Crocker, A. S. Hibbard, R. H. Pierce, A. V. Abbott, S. G. McMeen, R. E. Richardson, W. H. Merrill, C. G. Burton and W. M. Stine.

INSULATION AND CONDUCTION

Reginald A. Fessenden **Vol. xv—1898, pp. 119-151**

Theory of the conduction of electricity in solids, liquids, and gases. Requirements of an insulating material. Dielectric properties of various types of insulating materials.

Discussion, pp. 151-160, by Messrs. F. B. Crocker, W. S. Franklin, M. I. Pupin and R. A. Fessenden.

General remarks on the theory of insulation and conduction.

6. MAGNETIC PROPERTIES AND TESTING OF IRON

MAGNETIC RELUCTANCE

A. E. Kennelly Vol. viii—1891, pp. 485-517

Account of the development of the theory of magnetism, the polar, the vein and the circuit theories. Review of experiments made by Rowland, Ewing, Low and others. Typical magnetization curves for different grades of iron and steel and of nickel and cobalt at different temperatures. Reference to original articles and full data tabulated for all curves.

Discussion, pp. 518-532, by Messrs. A. E. Kennelly, Carl Hering, J. Stanford Brown, Louis Bell, Chas. E. Emery, M. I. Pupin, Charles P. Steinmetz and Thos. D. Lockwood.

Analogy between magnetic circuit and electric circuit and between magnetism and elasticity. Hysteresis in gases. General remarks on engineering formulas.

ON THE LAW OF HYSTERESIS

Charles P. Steinmetz Vol. ix—1892, pp. 3-51

Account of experimental investigation of magnetic hysteresis. Description of apparatus used and results of tests on different types of magnetic circuits and different qualities of material. Hysteretic constants for various classes of iron and steel.

Discussion, pp. 51-60, by Messrs. Thomas D. Lockwood, C. P. Steinmetz, Charles S. Bradley, Joseph Wetzler, A. E. Kennelly and M. I. Pupin.

General remarks on law of hysteresis.

RATIONAL AND EMPIRICAL FORMULAE SHOWING THE RELATION BETWEEN THE MAGNETOMOTIVE FORCE (H) AND THE RESULTING MAGNETIZATION (B)

Charles E. Emery Vol. ix—1892, pp. 192-222

Development of a rational method of calculating the magnetization of iron, based on analogy to the laws of mechanics.

No discussion.

THE MAGNETIC PERMEABILITY OF SPECIAL IRONS FOR ELECTRICAL PURPOSES

Milton E. Thompson, Percy H. Knight and Geo. W. Bacon. Vol. ix—1892, pp. 250-259

Magnetization curves of different qualities of iron and steel.

Discussion, pp. 259-262, by Messrs. H. S. Carhart, E. L. Nichols, C. E. Emery, D. C. Jackson and C. S. Bradley.

Magnetization curves of open hearth steel.

ON THE LAW OF HYSTERESIS. PART II

Charles P. Steinmetz Vol. ix—1892, pp. 621-724

Investigation of hysteresis between any two limits of flux density, either of opposite or of equal sign. Description of apparatus, method of measurement and development of equations relative to the quantities involved. Hysteresis with pulsating magnetism. Magnetic constants for different types of irons and steels. Magnetic characteristics of wire and laminations magnetized transversely. Meaning of the area of the hysteresis loop. Theory of molecular magnets.

Appendix I, pp. 725-729.

Relative Merits of Different Methods of Measuring Flux Density.

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Efficiency of Electro-magnetic Conversion of Energy. Limits of the Law of 1.6th Power.

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Limits of Linear Law of Metallic Reluctivity.

Discussion, pp. 730-744 and 748-755, by Messrs. W. J. Hammer, A. E. Kennelly and Wm. Stanley, Jr.

ON THE LAW OF HYSTERESIS, PART III, AND THE THEORY OF FERRIC INDUCTANCES

Charles P. Steinmetz **Vol. xi—1894, pp. 570-608**

Theory and laws of hysteresis. Mathematical treatment of the losses in iron by hysteresis and eddy currents. Distortion of exciting current at different flux densities.

Discussion, pp. 609-616, by Messrs. Frederick Bedell, C. P. Steinmetz, A. E. Kennelly and M. I. Pupin.

General remarks on hysteresis and exciting current wave distortion.

THE BEST METAL FOR FIELD MAGNET FRAMES

Alton D. Adams **Vol. xii—1895, pp. 18-20**

Comparison of weight of active materials and cost of various machines using cast iron and wrought iron in field circuit.

Discussion, pp. 20-33, by Messrs. Francis B. Crocker, Richard Fleming, Samuel Sheldon, A. E. Kennelly, Gano S. Dunn, James Burke, W. L. Bliss, Alton D. Adams, Mr. Edson, B. J. Arnold, L. L. Summers and C. A. Pratt.

Relative advantages of cast steel and wrought iron for field pole construction.

THE INFLUENCE OF HEAT TREATMENT UPON THE MAGNETIC PROPERTIES OF STEEL AND IRON

K. E. Guthe **Vol. xiv—1897, pp. 57-80**

Experimental investigation of the effects of various kinds of heat treatment upon the permeability and hysteresis of iron and steel.

Discussion, pp. 80-89, by Messrs. Henry S. Carhart, Paul A. N. Winand, M. I. Pupin, Nelson W. Perry, Elihu Thomson and J. Stanford Brown.

Theory of the constitution of steel. Specification for magnet steel.

7. BATTERIES

DEPOSITING VATS IN "SERIES"

H. B. Slater Vol. i—1884, pp. 1-4, paper No. 11

Description of practical experience in modification of electroplating vats, so as to double useful output of given generator.

Discussion, pp. 4-7, by Messrs. H. B. Slater, W. D. Sargent, N. S. Keith, E. A. Sperry, and Jas. Kelly.

General remarks on methods of connecting electrolytic vats.

DESCRIPTION OF A LARGE SECONDARY BATTERY PLANT FOR GENERAL COMMERCIAL DISTRIBUTION

E. P. Roberts Vol. ii—1885, pp. 1-3, paper No. 5

Brief description of an installation of batteries according to the Brush system for arc lighting, there being a separate battery in each block.

Discussion, pp. 3-20, by Messrs. W. A. Anthony, E. P. Roberts, ——— Hall, F. L. Pope, R. W. Pope, E. P. Thomson, S. F. Shelbourne, Geo. A. Hamilton, ——— Card, H. B. Slater, T. C. Martin, Rowland Hazard and ——— Carey.

Further information concerning the Brush battery system. General remarks on electric lighting.

SECONDARY BATTERIES FOR LIGHT AND POWER

A. H. Bauer Vol. iii—1886, pp. 129-136

Account of the practical development of the pasted or Faure type lead storage battery in Baltimore, with details of construction and operation in lighting, telegraphing and motor car service.

Discussion, pp. 136-144, by Messrs. Frank L. Pope, C. O. Mailloux, Sidney F. Shellbourne, A. C. Fowler, Jos. Wetzler and G. C. Maynard.

General remarks on the lead storage battery, its practicability and the patent situation with reference to it.

STORAGE BATTERIES IN PRACTICE

E. P. Roberts Vol. iv—1887, pp. 128-131

Brief statement of reasons for abandoning the Brush distributing battery system in favor of the central station.

Discussion, pp. 131-137, by Messrs. T. C. Martin, C. O. Mailloux, Jos. Wetzler, Geo. A. Hamilton, Ralph W. Pope, Frank L. Pope and Edward P. Thompson.

General remarks on the storage battery and its uses in lighting and traction.

ELECTRIC ENERGY FROM CARBON WITHOUT HEAT

Willard E. Case **Vol. v—1888, pp. 195-200**

Account of experiment with primary cell with graphite positive electrode.

Discussion, pp. 201-210, by Messrs. C. O. Mailloux, Townsend Wolcott, Jos. Wetzler, F. B. Crocker, C. S. Bradley, ——— Grimshaw and Willard E. Case.

Method of calculating theoretical e m. f. of any primary cell.

IMPOSSIBILITIES AND LIMITATIONS OF CHEMICAL GENERATORS OF ELECTRICITY

Francis B. Crocker **Vol. v—1888, pp. 277-288**

Description of method of calculating e. m. f. with large number of actual calculations compared with the observed values. Results of tests of e. m. f. of different metals, with free chlorine, bromine, and iodine in different electrolytes. Technical data on cells with zinc as electro-positive material and various depolarizers and electro-negative materials. Discussion of the efficiency and opportunities for improvement of chemical generators.

Discussion, pp. 288-294, by Messrs. Otto A. Moses, F. B. Crocker, P. H. Vander Weyde, Edw. L. Nichols, C. O. Mailloux and Elihu Thomson.

General remarks on the chemical generation of electric energy.

SOME RESULTS WITH SECONDARY BATTERIES IN TRAIN LIGHTING

Alexander S. Brown **Vol. vi—1889, pp. 205-210**

Brief account of experience of the Pennsylvania R. R. with Faure, Brush, Electric Accumulator Co., and Julien Electric Company batteries.

Discussion, pp. 210-216, by Messrs. George B. Prescott, Jr., C. O. Mailloux, Alex. S. Brown, William H. Pierce, Edward L. Nichols and W. B. Vansize.

General remarks on operation of storage batteries.

THE INHERENT DEFECTS OF LEAD SECONDARY BATTERIES

Louis Duncan and H. Wiegand **Vol. vi—1889, pp. 217-229**

Account of experimental investigation of the energy losses in lead storage batteries. Characteristics and magnitude of heat and chemical losses.

Discussion, pp. 229-236, by Messrs. Elihu Thomson, Louis Duncan, E. P. Roberts, Townsend Wolcott, C. O. Mailloux, George B. Prescott, Jr., Edward L. Nichols and Francis B. Crocker.

General remarks on the losses in storage batteries.

SOME METHODS OF REGULATING ACCUMULATORS IN ELECTRIC LIGHTING

George B. Prescott, Jr. **Vol. vi—1889, pp. 439-475**

Discussion of the uses of storage batteries in connection with lighting plants to help out the load factor and to save distribution copper. Description of typical installation, showing the use of overload and underload circuit breakers and counter e. m. f. cells with automatic end cell switches. Circuit diagrams.

Discussion pp. 476-485, by Messrs. George B. Prescott, Jr., Townsend Wolcott, T. C. Martin, John W. Howell, R. W. Pope, Joseph Wetzler and Elihu Thomson.

Description of method of automatically maintaining constant e. m. f. at battery terminals.

NOTE ON A NEW GRAVITY CELL

P. B. Delany Vol. vi—1889, pp. 514-515

Description of modified form of gravity battery.

Discussion (including that of paper by P. B. Delany on "Telegraph Line Adjustment"), pp. 515-518, by Messrs. C. L. Healy, P. B. Delany, R. W. Pope, Alfred G. Compton and T. C. Martin.

RELATION BETWEEN THE ELECTROMOTIVE FORCE OF A CLARK CELL AND THE DENSITY OF THE ZINC SULPHATE SOLUTION

H. S. Carhart Vol. ix—1892, pp. 614-617

Results of experimental investigation of the Clark cell, determining the temperature coefficient of resistance

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SOME STORAGE BATTERY PHENOMENA

W. W. Griscom Vol. xi—1894, pp. 302-319

Characteristic performance of Planté, chloride and pasted cells, showing variation of the various properties. Rating and care of batteries so as to prolong their lives.

Discussion, pp. 320-336, by Messrs. Louis Duncan, W. W. Griscom, Townsend Wolcott, David Solomons and Frederick Reckenzaun.

General remarks on the performance of storage batteries.

STORAGE BATTERY APPLICATIONS

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A topical discussion by Messrs. Arthur E. Childs, C. L. Edgar Nelson W. Perry, Francis B. Crocker, Carl Hering, Frederick Reckenzaun, Townsend Wolcott, H. Ward Leonard, J. B. Entz, J. R. Williams, J. Appleton, Chas. Blizard, E. T. Birdsall, J. W. Lieb, Jr., Arthur V. Abbot, Franz J. Dommerque, Ludwig Gutmann, Mr. Sheehy, M. H. Gerry, Jr., B. J. Arnold, Mr. MacFadden, Prof. Carhart, W. M. Stine, and Mr. Feldman.

Storage batteries in central stations, covering performance characteristics, economics and experience in various classes of service. Factors which affect the design of batteries for different kinds of service. General discussion of the storage battery situation. Storage battery vs. gas engine for standby service.

ELECTRIC ELEVATORS WITH DETAILED DESCRIPTION OF SPECIAL TYPES

Frank J. Sprague **Vol. xiii—1896, pp. 3-22**

Comparison of electric with hydraulic elevators. Detailed description of Sprague-Pratt multiple screw elevator.

Discussion, pp. 23-33 and 37-67, by Messrs. C. P. Steinmetz, Cary T. Hutchinson, James Hamblet, George Hill, Frank J. Sprague, Charles E. Emery, H. Ward Leonard, C. O. Mailloux, F. S. Holmes, F. B. Crocker, R. H. Pierce, Frank B. Rae, B. J. Arnold, W. M. Stine, S. G. Meiler, J. F. Stevens, Albert Scheible, J. W, Lieb, Jr,, and John D. Ihlder.

Comparison of electric and hydraulic elevators as to operation and maintenance. Test of electric elevator plants and heating required in various buildings. Economics of application of storage battery to elevator plant.

A NOVEL FORM OF THERMO-ELECTRIC BATTERY

C. J. Reed **Vol. xv—1898, pp. 223-242**

Theory of thermo-electric battery based on experimental investigation. Description of investigations and results obtained with different types of electrodes and electrolytes. Graphic records of e. m. f. temperature characteristics of different types of cells.

Discussion, pp. 242-257, by Messrs. E. P. Thompson, C. J. Reed, C. O. Mailloux, H. Ward Leonard, George F. Atwood, J. P. Wintringham, C. P. Steinmetz, R. W. Pope and W. M. Mordey.

General remarks on cause of contact electromotive force.

STORAGE BATTERIES AND RAILWAY POWER STATIONS

Robert Mc A. Lloyd **Vol. xvi—1899, pp. 45-60**

Analysis of economies obtainable by the installation of large storage batteries in railway power stations. Load curves from different stations showing results attained.

Discussion, pp. 61-89, by Messrs. A. E. Kennelly, George Hill, C. O. Mailloux, E. T. Birdsall, F. V. Henshaw, R. McA. Lloyd, J. M. Smith, F. S. Holmes, H. B. Coho, Joseph Bijur, R. H. Pierce, Alex Dow, Maurice Coster, Joseph Appleton, P. W. Knox and B. J. Arnold.

Experience with different types of storage batteries in power stations. Depreciation of storage batteries.

8. TRANSFORMERS

PHENOMENA OF RETARDATION IN THE INDUCTION COIL

William Stanley, Jr. **Vol. v—1888, pp. 97-108**

Discussion of alternating current phenomena, comparison of efficiency and losses in alternating current and direct current generators; explaining the mode of operation of transformers, action of induction coil in series with arc lamps.

Discussion, pp. 108-134, by Messrs. Townsend Wolcott, William Stanley, Jr., Hubert Howson, S. S. Wheeler, P. H. Vander Weyde, George B. Prescott, Jr., C. O. Mailloux, E. W. Rice, Jr., T. C. Martin, Jos. Wetzler and J. W. Howell.

General remarks on the operation of alternating current apparatus. Reference to hysteresis. Description of auto-transformer. Difficulties experienced in parallel operation of alternating current generators. Mode of operation of synchronous motors.

TRANSFORMERS

Harris J. Ryan **Vol. vii—1890, pp. 1-19**

Account of experimental investigation of the performance of a transformer, describing the methods and apparatus employed. Wave form of e. m. f.'s load current and exciting current measured by point-by-point method. Efficiency and losses at different loads.

Discussion, pp. 19-29, by Messrs. Townsend Wolcott, H. J. Ryan, Nikola Tesla, A. E. Kennelly, William E. Geyer, Joseph Wetzler, C. O. Mailloux, E. G. Acheson and L. B. Stillwell.

Varying opinions as to cause of distortion in the exciting current wave.

SOME TESTS ON THE EFFICIENCY OF ALTERNATING CURRENT APPARATUS

Louis Duncan and W. F. C. Hasson **Vol. vii—1890, pp. 109-117**

Brief description of the efficiency test made on 750-lamp Westinghouse a. c. generator and distribution transformers. Discussion of effect of all-day efficiency upon system using large number of small transformers.

Discussion, pp. 118-127, by W. A. Anthony, Nikola Tesla, H. Ward Leonard, S. S. Wheeler, Louis Duncan, O. T. Crosby, Frederick Darlington, John Millis, Townsend Wolcott, M. I. Pupin, and J. B. Entz.

General remarks on transformer design. Comparative efficiency of direct-current with alternating-current distribution system.

PRACTICAL ASPECTS OF THE ALTERNATING CURRENT THEORY

M. I. Pupin **Vol. vii—1890, pp. 204-217**

Brief résumé of the development of fundamental laws of electricity, giving the discoveries of the laws and the date of discovery. Mathematical consideration of the ideal transformer.

Discussion, p. 287, by Messrs. O. T. Crosby, M. I. Pupin and Elihu Thomson.

EFFICIENCY OF THE TRANSFORMER

Calvin Humphrey and William H. Powell Vol. vii—1890, pp. 311-323

Experimental investigation of the exciting current wave form under various kinds of loads. Full load and all-day efficiency of 40-lamp transformer.

Discussion, incorporated with that of paper by Harris J. Ryan on "Some Experiments Upon Alternating Current Apparatus."

SOME EXPERIMENTS UPON ALTERNATING CURRENT APPARATUS

Harris J. Ryan Vol. vii—1890, pp. 324-336

Experimental investigation of the effect of external heating upon transformer core losses. Exciting current wave form and hysteresis loops under different conditions of magnetization.

Discussion (including that of paper by Messrs. Calvin Humphrey and William H. Powell on "Efficiency of the Transformer"), pp. 336-342, by Messrs. W. E. Geyer, H. J. Ryan, Louis Bell, William H. Powell, Townsend Wolcott, William Stanley, Jr., Joseph Wetzler, and Charles P. Steinmetz.

HEDGEHOG TRANSFORMER AND CONDENSERS

Frederick Bedell, K. B. Miller, and G. F. Wagner Vol. x—1893, pp. 497-518

Description of point-by-point method of measuring wave form by means of Bedell-Ryan revolving contact maker. Complete reference covering history of development of point-by-point method. Description of hedgehog transformer and account of performance tests made with current and e. m. f. wave meters. Study of the effect of condensers on line current.

Discussion, pp. 519-527, by Messrs. A. E. Kennelly, M. I. Pupin, Charles E. Emery, Frederick Bedell, and Charles P. Steinmetz.

General remarks on performance of ordinary hedgehog transformer. Observed dielectric hysteresis loop.

PRACTICAL PROPERTIES OF POLYPHASE APPARATUS

Louis Bell Vol. xi—1894, pp. 3-31

General résumé of the important characteristics of the various elements that make up a polyphase system—generators, synchronous and induction motors, transformers, synchronous converters, and the line. Choice of frequency and voltage for transmission.

Discussion, pp. 32-48, by Messrs. Louis Bell, William Stanley, Charles P. Steinmetz, O. T. Crosby, C. O. Mailloux, Frederick Darlington, and M. I. Pupin.

THEORY OF THE GENERAL ALTERNATING CURRENT TRANSFORMER

Charles P. Steinmetz Vol. xii—1895, pp. 245-256

Fundamental equations of the transformer and induction motor.

Discussion, pp. 256-259, by Messrs. M. I. Pupin and Charles P. Steinmetz.

PHASING TRANSFORMERS

Charles S. Bradley Vol. xii—1895, pp. 505-517

Development of phase splitting device for operation.

Discussion, pp. 518-524, by Messrs. Charles E. Emery, Nelson W. Perry, Charles S. Bradley, Louis Duncan, Joseph Sachs, W. E. Geyer, A. E. Kennelly, Cary T. Hutchinson, F. N. Waterman and W. M. Stine.

Description of contact method of observing wave form.

AN ANALYSIS OF TRANSFORMER CURVES

Charles K. Huguet Vol. xiii—1896, pp. 207-216

Analytical and experimental study of the cause of distortion of exciting current.

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Relation of hysteresis to distortion of exciting current.

A NEW FORM OF INDUCTION COIL

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Description of apparatus.

Discussion, p. 230, by Messrs. A. E. Kennelly and Elihu Thomson.

THE STANDARDIZING OF GENERATORS, MOTORS AND TRANSFORMERS

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Topical discussion of the advantages of standardization and the proposed scope of rules to be formulated by the Institute.

ALTERNATING CURRENT TRANSFORMERS FROM THE STATION MANAGER'S VIEWPOINT

W. F. White Vol. xv—1898, pp. 505-514

Presentation of the advantages of a single large transformer over a number of smaller ones. Experience as to the actual savings in favor of the single transformer.

No discussion.

THE DESIGN OF TRANSFORMERS

Frederick W. Carter Vol. xv—1898, pp. 639-700

Analytical study of transformer design with development of equations for determining the dimensions so as to give maximum all-day efficiency.

Discussion, pp. 701-717, by Messrs. M. I. Pupin, W. S. Franklin, Townsend Wolcott, Walter S. Moody, A. E. Kennelly Philippo Torchio, F. V. Henshaw, James Hamlet, F. W. Carter and D. C. Jackson.

General remarks on calculation of transformer design.

SERIES ARC LIGHTING FROM CONSTANT CURRENT TRANSFORMERS

William Lispenard Robb **Vol. xvi—1899, pp. 533-540**

Description of constant current transformer installation in Hartford, Conn. Results of performance tests.

Discussion, pp. 541-596, by Messrs. C. P. Steinmetz, J. H. Hallberg, Robert Fleming, C. O. Mailloux, W. L. Robb and H. H. Wait.

General remarks on alternating versus direct enclosed arc lamps. Comparative costs and cost of operation of various methods of arc lighting.

9. ELECTRICAL MACHINERY AND APPARATUS

A. DIRECT-CURRENT MACHINES

AN EXPERIMENTAL METHOD OF STUDYING THE DYNAMO MACHINE

C. F. Brackett — **Vol. i—1884, pp. 1-3, paper No. 7**

Description of a method of explaining the magnetic field of an experimental generator, designed to show the effect of iron in the armature core and that of current in the armature winding.

Discussion, pp. 3-4, by Messrs. N. S. Keith, C. F. Brackett and E. A. Sperry.

THE PRACTICAL REQUIREMENTS OF SMALL MOTORS

S. S Wheeler — **Vol. iv—1887, pp. 58-65**

Discussion of requirements of small electric motors. Discussion of a new design of small direct current motor with gramme ring armatures.

Discussion, pp. 65-82, by Messrs. Sidney F. Shelbourne, ——— Diehl, G. W. Mansfield, ——— Wing, C. S. Bradley, S. S. Wheeler, C. O. Mailloux, J. M. Pendleton, ——— Curtis, T. C. Martin, G. A. Hamilton and Jos. Wetzler.

General remarks on battery fed motors for sewing machines, fans, etc.; the requirements of the service and characteristics of commercial equipments.

THE RELATION BETWEEN THE CROSS-SECTION OF THE IRON IN THE ARMATURE AND FIELD OF THE GRAMME DYNAMO

Dugald C. Jackson — **Vol. iv—1887, pp. 148-154**

Account of tests on an experimental dynamo, giving the magnetization curves for different ratios of armature core section to field core section.

Discussion, pp. 154-160, by Messrs. S. S. Wheeler, Elihu Thomson and C. O. Mailloux.

Factors that enter into the design of dynamos. Conditions of instability in arc lamp circuits.

ELECTRIC MOTOR REGULATION

Francis B. Crocker — **Vol. vi—1889, pp. 237-252**

Comprehensive review of different methods of regulating the speed of direct current motors for operation with constant e. m. f. and with constant current. Circuit diagrams.

Discussion, pp. 252-263, by Messrs. Townsend Wolcott, Francis B. Crocker, Edward Weston, S. S. Wheeler, Joseph Wetzler, C. O. Mailloux, E. P. Roberts, E. L. Nichols, and Elihu Thomson.

General remarks on speed control of d. c. motors. Suggested control by periodically short circuiting field winding and varying the period. Methods of controlling constant current motors.

ELECTRICITY IN THE NAVY

Gilbert Wilkes **Vol. vii—1890, pp. 155-160**

Ideal requirements for a marine generator. Naval practice as to type, voltage, power capacity, etc., of the generator unit.

Discussion, pp. 160-162, by Messrs. Otto A. Moses, Gilbert Wilkes, Townsend Wolcott, R. N. Bayles, E. T. Birdsall, and Robert S. Dobbie.

Effect of electric plant upon compass.

MAGNETIC DATA OF THE SPRAGUE STREET CAR MOTOR

H. F. Parshall **Vol. vii—1890, pp. 218-224**

Construction of the magnetic circuit. Magnetic leakage factors for different parts of the circuit. Magnetization characteristics under various conditions of magnetic circuit.

Discussion, p. 225, by Louis Bell.

ON THE THEORY OF COMPOUND WINDING FOR CONSTANT POTENTIAL

Louis Bell **Vol. vii—1890, pp. 418-426**

Development of formula for series turns for compound winding on constant potential generator. Comparison with other formula.

Discussion, pp. 427-433, by Messrs. Townsend Wolcott, Louis Bell, A. E. Kennelly, F. B. Crocker, Justus B. Entz and C. O. Mailloux.

General remarks on compounding of generators.

THE PERFECTION OF STATIONARY ELECTRIC MOTORS

Francis B. Crocker **Vol viii—1891, pp. 187-200**

Discussion of the requirements of small direct current motors, followed by description of 3 h.p. Crocker-Wheeler motor, and table of dimensions of line Crocker-Wheeler motors.

Discussion, pp. 201-213, by Messrs. W. A. Anthony, A. Langstaff Johnston, F. C. Crocker, W. J. Hammer, Edward P. Thompson, Edw. C. Boynton, Jr., C. O. Mailloux, S. S. Wheeler, J. Martin and Thos. D. Lockwood.

General remarks on direct current motor design.

ON THE RELATION OF THE AIR GAP AND THE SHAPE OF THE POLES TO THE PERFORMANCE OF AUTOMATIC ELECTRIC MACHINERY

Harris J. Ryan **Vol. viii—1891, pp. 451-467**

Analytical and experimental study of the effect of pole face design on armature reaction. Effect of pole face slots on flux distribution under various loads. Conditions necessary for constant current regulation.

Discussion, pp. 467-480, by Messrs. T. D. Lockwood, W. A. Anthony, Townsend Wolcott, C. O. Mailloux, J. Stanford Brown and Nikola Tesla.

Advantages of small air gap in electric machine design.

THE REVERSAL OF POLARITY IN PLATING DYNAMOS

Harris J. Ryan **Vol. ix—1892, pp. 525-526**

Experimental determination of the voltaic action between unplated carbon and copper.

No discussion.

ELECTRIC RAILWAY MOTOR TESTS

George B. Shepardson and Edward P. Burch **Vol. ix—1892, pp. 578-593**

Performance tests of Sprague and Thomson-Houston motors, and also current and power consumption tests of cars on Minneapolis street railway.

Discussion (including that of paper by N. W. Perry on "Series Electric Traction" and paper by H. Ward Leonard on "A New System of Electric Propulsion"), pp. 595-600 and 761-793, by Messrs. Frank J. Sprague, C. E. Emery, C. S. Bradley, E. F. Thomas, H. Ward Leonard, C. T. Hutchinson, C. O. Mailloux, F. B. Crocker, Charles Hewitt and F. V. Henshaw.

General remarks on the relative efficiency of different types of railway motor control, including commutated fields, rheostat and Ward Leonard system.

MICANITE, AND ITS APPLICATION TO ARMATURE INSULATION

Edward P. Thompson for Chas. W. Jefferson and Arthur H. S. Dyer **Vol. ix—1892, pp. 798-810**

Brief reference to early methods of insulating armatures. Characteristics of mica and description of different commercial forms of micanite used in the insulation of armatures and commutators.

Discussion, pp. 811-823, by Messrs. W. J. Hammer, W. A. Anthony, Carl Hering, Charles W. Jefferson, R. W. Pope, F. B. Crocker, E. P. Thompson, L. W. Kingsley, C. P. Steinmetz, J. B. Williams and A. E. Kennelly.

General remarks on the characteristics and testing of insulation.

AN EARLY DYNAMO

Townsend Wolcott **Vol. x—1893, pp. 166-171**

Editorial from New York *Tribune* on electric light (1867). Also article from *Scientific American.*

HEATING OF ARMATURES

A. H. and C. E. Timmerman **Vol. x—1893, pp. 336-358**

Description of experimental investigation of heating of drum armature showing effect of speed, pole arc, and temperature rise on heat dissipation constants. Results tabulated and plotted as curves.

UNIPOLAR DYNAMOS FOR ELECTRIC LIGHT AND POWER

F. B. Crocker and C. H. Parmly **Vol. xi—1894, pp. 406-422**

History of development of acyclic generators. General theory and practical design of such machines.

Discussion, pp. 423-429, by Messrs. Carl Hering, F. B. Crocker, William Stanley and A. E. Kennelly.

General remarks on acyclic generator design.

TEST OF A CLOSED-COIL ARC DYNAMO

R. B. Owens and C. A. Skinner **Vol. xi—1894, pp. 441-459**

Dimensions, construction and design data for 25-lamp Wood arc machine. Flux distribution curves at different loads, e. m. f. characteristics, efficiency curve and losses; tests.

Discussion, pp. 460-464, by Messrs. C. N. Black and C. P. Steinmetz.

General discussion of the design of constant-current generators.

RELATIVE ADVANTAGES OF TOOTHED AND SMOOTH CORE ARMATURES

Alton D. Adams **Vol. xi—1894, pp. 465-468**

Statement of the chief advantages of each type of construction.

Discussion, pp. 469-475 and 637-638, by Messrs. A. E. Wiener, C. P. Steinmetz, Gano S. Dunn, William Stanley, C. N. Black, A. E. Kennelly, and A. D. Adams.

General remarks on relative advantages of toothed and smooth cores as to leakage, flux distribution, commutation, armature reaction, etc. Toothed vs. smooth armature with regard to sparking.

THE BEST METAL FOR FIELD MAGNET FRAMES

Alton D. Adams **Vol. xii—1895, pp. 18-20**

Comparison of weight of active materials and cost of various machines using cast iron and wrought iron in field circuit.

Discussion, pp. 20-33, by Messrs. Francis B. Crocker, Richard Fleming, Samuel Sheldon, A. E. Kennelly, Gano S. Dunn, James Burke, W. L. Bliss, Alton D. Adams, Mr. Edson, B. J. Arnold, L. L. Summers and C. A. Pratt.

Relative advantages of cast steel and wrought iron for field pole construction.

A METHOD OF PREVENTING ARMATURE REACTION

Harris J. Ryan and Milton E. Thompson **Vol. xii—1895, pp. 80-108**

Description of the design, construction and performance of several d. c. generators equipped with an auxiliary pole face winding for compensating armature reaction. Design data, flux distribution curves and other experimental results.

Discussion, pp. 109-128, by Messrs. Townsend Wolcott, W. L. Bliss, E. A. Merrill, Cary T. Hutchinson, Chas. S. Bradley, C. O. Mailloux, Charles E. Emery, A. E. Kennelly, Gano S. Dunn, Maxwell M. Mayer, Harris J. Ryan, B. J. Arnold, A. V. Abbott, W. M. Stine, C. E. Kammeyer, Prof. Fortenbaugh, L. L. Summers, Mr. Cochrane, O. S. Lyford, Jr., and Ludwig Gutmann.

Criticisms of author's method. Design of direct-current machines for sparkless operation.

LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.

Clarence E. Gifford Vol. xii—1895, pp. 260-267

Description of method for locating grounds in armature and field windings.

No discussion.

COMPOUNDING DYNAMOS FOR ARMATURE REACTION

Elihu Thomson Vol. xii—1895, pp. 288-297

Description of shunt-wound machine with duplicate set of dead poles arranged to compound automatically by utilizing armature reaction. Account of compound tests with results of the tests.

No discussion.

VOLTS VS. OHMS

Speed Regulation of Electric Motors

H. Ward Leonard Vol. xiii—1896, pp. 377-386

Description of various e. m. f. systems of motor speed control invented by the author.

Discussion, pp. 387-399, by Messrs. G. S. Dunn, C. T. Hutchinson, F. A. Pattison, James Burke, C. P. Steinmetz, R. T. Lozier, William Elmer, Jr., H. Ward Leonard and E. R. Carichoff.

General remarks on the efficiency and economics of the Ward Leonard system of motor control.

SPARKING, ITS CAUSE AND EFFECTS

Thorburn Reid Vol. xiv—1897, pp. 579-590

Energy theory of sparking in commutation. Conditions necessary for the realization of perfect commutation.

Discussion, pp. 591-606, by Messrs. C. P. Steinmetz, Gano S. Dunn, Thorburn Reid, A. E. Kennelly and Wm. E. Geyer.

General remarks on the theory of commutation and the prevention of sparking.

THE STANDARDIZING OF GENERATORS, MOTORS AND TRANSFORMERS

Vol. xv—1898, pp. 3-32

Topical discussion of the advantages of standardization and the proposed scope of rules to be formulated by the Institute.

AIR-GAP AND CORE DISTRIBUTION

W. E. Goldsborough Vol. xv—1898, pp. 515-530

Development of method for calculating flux density at the armature surface.

No discussion.

MOTOR SPEED REGULATION

Alton D. Adams Vol. xvi—1899, pp. 443-445

Attention called to inefficiency of armature resistance method and desirability of controlling the speed by varying the strength of magnetic field.

Discussion, pp. 446-447, by Messrs. J. B. Blood and C. A. Adams.

Advantages of e. m. f. method of speed control.

AIR-GAP AND CORE DISTRIBUTION

W. E. Goldsborough Vol. xvi—1899, pp. 461-480

Experimental investigation of the distribution of flux in an iron core under different conditions of load and position with reference to the field pole.

Discussion, pp. 481-483, by Messrs. C. P. Steinmetz, J. B. Blood and W. E. Goldsborough.

Practical value of author's results.

CONNECTED RAILWAY UNIT AT DIFFERENT LOADS. TEST OF A 300-KILOWATT DIRECT

Edward J. Willis Vol. xvi—1899, 599-603

Tabulated data from a steam-electric power plant consisting of water tube boiler, tandem compound condensing engine railway generator.

Discussion, pp. 604-606, by Messrs. A. E. Kennelly, George F. Sever, E. J. Willis, George Hill and C. O. Mailloux.

B. SYNCHRONOUS MACHINES

SOME TESTS ON THE EFFICIENCY OF ALTERNATING-CURRENT APPARATUS

Louis Duncan and W. F. C. Hasson Vol. vii—1890, pp. 109-117

Brief description of the efficiency test made on 750-lamp Westinghouse a. c. generator and distribution transformers. Discussion of effect of all-day efficiency upon system using large number of small transformers.

Discussion, pp. 118-127, by W. A. Anthony, Nikola Tesla, H. Ward Leonard, S. S. Wheeler, Louis Duncan, O. T. Crosby, Frederick Darlington, John Millis, Townsend Wolcott, M. I. Pupin and J. B. Entz.

General remarks on transformer design. Comparative efficiency of direct-current with alternating-current distribution system.

INVESTIGATION OF THE STANLEY ALTERNATE CURRENT ARC DYNAMO

W. B. Tobey and G. B. Walbridge Vol. vii—1890, pp. 367-378

Description of the Stanley arc generator and of performance tests at different loads. Curves of e. m. f., current, power and exciting current taken by point-by-point method for different loads. E. m. f. characteristic of carbon arc.

Discussion, incorporated with that of paper by Thorburn Reid on "A New Method of Analyzing the Magnetic Reactions of Armatures Applied to the Stanley Arc-Light Alternating Current Machine."

A NEW METHOD OF ANALYZING THE MAGNETIC REACTIONS OF ARMATURES APPLIED TO THE STANLEY ARC-LIGHT ALTERNATING CURRENT MACHINE

Thorburn Reid **Vol. vii—1890, pp. 379-390**

Development of method of calculating e. m. f. and current regulation of Stanley arc machine.

Discussion (including that of paper by Messrs. W. B. Tobey and G. B. Walbridge on "Investigation of the Stanley Alternate Current Arc Dynamo"), pp. 391-406, by Messrs. William Stanley, Jr., A. E. Kennelly, R. W. Pope, Thomas D. Lockwood, E. T. Birdsall, W. B. Tobey, Charles P. Steinmetz, Thorburn Reid, C. O. Mailloux, M. I. Pupin, Cary T. Hutchinson, T. C. Martin, S. S. Wheeler, Geo. M. Phelps and W. E. Geyer.

General remarks on calculation of regulation of arc machines. Motion to support Electrical Industries Census bill before Congress.

A NEW METHOD OF ANALYZING ARMATURE REACTIONS OF ALTERNATORS

Charles P. Steinmetz **Vol. vii—1890, pp. 434-438**

Development of equation for calculation of effect of armature reaction upon the e. m. f. of constant potential and upon the current of constant-current alternators.

Discussion, pp. 439-445, by Messrs. Thorburn Reid and Charles P. Steinmetz.

A STUDY OF AN OPEN COIL ARC DYNAMO

Milton E. Thompson **Vol. viii—1891, pp. 375-388**

Explanation of mode of operation of Thompson open circuit arc generator, followed by account of experimental determination of curves of e. m. f. and current at terminals of machine and of one coil, with photographs of curves. Data for external and internal characteristics.

Discussion, pp. 389-395, by Messrs. Elihu Thomson, Geo. E. Geyer, Edw. L. Nichols, E. W. Rice, Jr., and W. H. Wahl.

Explanation of action of an air blast in extinguishing sparks. Method of regulating Thomson machine.

ON POLYPHASAL GENERATORS

M. I. Pupin **Vol. viii—1891, pp. 562-585**

Mathematical analysis of a simple three-phase generator with no armature reaction, no hysteresis and no eddy currents, the object being to show what wave form must be chosen to give rotating field of constant strength.

Discussion, pp. 586-600, by Messrs. Elihu Thomson, Charles P. Steinmetz, M. I. Pupin, C. S. Bradley and A. E. Kennelly.

Action of inductance in eliminating higher harmonics. Generation of revolving field of constant strength with pure sine waves. Reference to the early work of Ferraris with polyphase systems.

PRACTICAL PROPERTIES OF POLYPHASE APPARATUS

Louis Bell **Vol. xi—1894, pp. 3-31**

General résumé of the important characteristics of the various elements that make up a polyphase system—generators, synchronous and induction motors, transformers, synchronous converters, and the line. Choice of frequency and voltage for transmission.

Discussion, pp. 32-48, by Messrs. Louis Bell, William Stanley, Charles P. Steinmetz, O. T. Crosby, C. O. Mailloux, Frederick Darlington and M. I. Pupin.

THEORY OF THE SYNCHRONOUS MOTOR

Charles P. Steinmetz **Vol. xi—1894, pp. 763-776**

Development of equation for synchronous motor operating under various conditions, current, phases and load characteristics.

Discussion, pp. 777-783, by Messrs. A. E. Kennelly, M. I. Pupin, C. P. Steinmetz and M. A. Edson.

General remarks on the theory of the synchronous motor and the induction motor.

SOME FEATURES OF ALTERNATING CURRENT SYSTEMS

Charles P. Steinmetz **Vol. xii—1895, pp. 326-349**

Analytical study of power characteristics of single and polyphase circuits, leading up to the development of the monocyclic system of operation. Description of the monocyclic motor.

No discussion.

SOME OBSERVATIONS ON A DIRECT-CONNECTED 300-KW. MONOCYCLIC ALTERNATOR

Dugald C. Jackson and S. B. Fortenbaugh **Vol. xii—1895, pp. 350-353**

Input and output curves.

Discussion, pp. 354-357, by Messrs. E. J. Berg, Gano S. Dunn, S. B. Fortenbaugh and Charles P. Steinmetz.

Transformer connections in monocyclic system. Equation for teaser e. m. f.

THE EFFECT OF ARMATURE INDUCTANCE UPON ELECTROMOTIVE FORCE CURVES OF AN ALTERNATOR

W. E. Goldsborough **Vol. xiv—1897, pp. 275-312**

Account of experimental investigation of the effects of inductance upon the e. m. f. wave form of a Brush arc generator.

Discussion, pp. 313-316, by Messrs. C. P. Steinmetz, Gano S. Dunn and W. E. Goldsborough.

THE COMMUTATED CURRENT WAVE OF A COMPOSITE-WOUND ALTERNATOR

Dugald C. Jackson **Vol. xv—1898, pp. 403-408**

Observed waves of Thomson-Houston 125-cycle generator.

No discussion.

C. INDUCTION MACHINES

A NEW SYSTEM OF ALTERNATE-CURRENT MOTORS AND TRANSFORMERS

Nikola Tesla Vol. v—1888, pp. 305-324

Description of the Tesla polyphase system of producing a rotating field. Simple explanation of the mode of operation of the induction motor, pointing out some of its characteristics and possibilities.

Discussion, pp. 324-327, by Messrs. W. A. Anthony, Nikola Tesla and Elihu Thomson.

Account of tests on Tesla's early motor.

SOME FACTS ABOUT POLYPHASE MOTORS

Louis Bell Vol. xi—1894, pp. 559-568

Outline of ideal properties of an electric motor, followed by discussion of the polyphase induction motor, comparing it with ideal requirements. Comparisons of polyphase motor and d. c. motors as to performance.

Discussion, p. 569, by Messrs. Carl Hering and C. P. Steinmetz.

EXPERIMENTS ON TWO-PHASE MOTORS

Louis Duncan, S. H. Brown, W. P. Anderson and S. Q. Hayes Vol. xi—1894, pp. 617-632

Experimental investigation of the wave form of e. m. f. and current in the primary and secondary of a 2-hp. Tesla induction motor.

Discussion, pp. 632-636, by Messrs. C. P. Steinmetz, C. F. Scott, W. A. Anthony and M. I. Pupin.

Effect of third harmonic on rotating field of two-phase and three-phase motor.

THEORY OF TWO AND THREE PHASE MOTORS

Lieut. Samuel Reber Vol. xi—1894, pp. 731-747

Development of equations for electrical losses, and torque under various conditions of operation, neglecting the iron losses and variations in permeability.

Discussion, pp. 748-762, by Messrs. M. I. Pupin, C. P. Steinmetz, W. M. Stine and H. J. Sage.

Mathematical theory of induction motor.

THEORY OF THE GENERAL ALTERNATING CURRENT TRANSFORMER

Charles P. Steinmetz Vol. xii—1895, pp. 245-256

Fundamental equations of the transformer and induction motor.

Discussion, pp. 256-259, by Messrs. M. I. Pupin and Charles P. Steinmetz.

THE ALTERNATING CURRENT INDUCTION MOTOR

C. P. Steinmetz Vol. xiv—1897, pp. 185-217

Analytical study of the performance of induction motors with different values of resistance, reactance and condesance in the motor circuits. Load and speed characteristics plotted as curves.

Discussion, pp. 218-223, by Messrs. F. B. Crocker, Elihu Thomson, W. E. Goldsborough, A. E. Kennelly, F. A. C. Perrine and C. P. Steinmetz.

SINGLE PHASE INDUCTION MOTOR

Charles P. Steinmetz Vol. xv—1898, pp. 35-106

Analytical study of the performance of single-phase induction motor and the principles of design. Effect of different types of starting devices upon the performance. Performance characteristics plotted as curves.

Discussion, pp. 106-118, by Messrs. F. B. Crocker, A. E. Kennelly, C. P. Steinmetz, W. S. Franklin, Townsend Wolcott and E. E. Ries.

Discussion of different methods of presenting single-phase induction motor theory.

SOME TESTS WITH AN INDUCTION GENERATOR

A. F. McKissick Vol. xv—1898, pp. 409-424

Experimental investigation of the performance of an induction generator, characteristics being plotted as curves.

D. ALTERNATING-CURRENT COMMUTATOR MACHINES

ALTERNATING CURRENT ELECTRIC MOTORS

Louis Duncan Vol. v—1888, pp. 211-221

General remarks on the value of motor load in improving the load factor of a central station, followed by brief descriptions of the series commutator, the synchronous and the Thomson repulsion motors and a short discussion of the advantages and disadvantages of each type.

Discussion, pp. 222-225, by Messrs. Townsend Wolcott, C. O. Mailloux, F. B. Crocker, F. J. Patten, Louis Duncan, S. S. Wheeler, R. M. Hunter and ——— Waring.

General discussion of alternating current motors. Description of Patten eddy current repulsion motor. Use of resistance to prevent sparking in commutation.

ALTERNATING CURRENT MOTORS: THE EVOLUTION OF A NEW TYPE

F. Jarvis Patten Vol. vi—1889, pp. 388-397

Description of a double commutator a. c. motor, with circuit diagrams of the different modifications passed through in the process of its development.

Discussion, pp. 397-410, by Messrs. E. Jarvis Patten, C. O. Mailloux, R. S. Dobbie, Lemuel W. Serrell, H. Ward Leonard, Allen D. Garratt, E. P. Clark, E. P. Thompson, Elihu Thomson, N. F. Collins, D. C. Jackson, C. J. Reed, E. T. Birdsall and Ludwig Gutmann.

Further data on the Patten a. c. commutator motor. Brief description of Mordey a. c. commutator machine.

A PROPOSED SYSTEM OF ALTERNATING-DIRECT-CURRENT TRANSFORMATION

F. Jarvis Patten Vol. ix—1892, pp. 66-80

Description of various arrangements of the Patten motor in combination with a Shuckert converter so as to transform single-phase energy to polyphase energy or to direct current.

Discussion, pp. 80-94, by Messrs. F. B. Crocker, Carl Hering, F. Jarvis

Patten, E. T. Birdsall, M. I. Pupin, Louis Bell, A. E. Kennelly, C. O. Mailloux, Cary T. Hutchinson, Charles Hewitt, Charles P. Steinmetz and Elihu Thomson.

General remarks on transformation of alternating into direct current and characteristics of rectified current.

E. CONVERTERS

EXISTING COMMERCIAL APPLICATIONS OF ELECTRICAL POWER FROM NIAGARA FALLS

W. L. R. Emmet **Vol. xii—1895, pp. 482-492**

Description of substation apparatus of Pittsburg Reduction Company and the Carborundum Company for transforming alternating current to direct current.

Discussion, pp. 492-499, by Messrs. Jules Neher, W. L. R. Emmet, Charles P. Steinmetz and L. B. Stillwell.

Factors entering into the design of synchronous converters for large current values.

ARMATURE REACTIONS IN A ROTARY CONVERTER

Robert R. Owens, D. W. Hawksworth and H. W. Doubrava **Vol. xiv—1897, pp. 457-468**

Experimental investigation of the effects of load current upon e. m. f. wave form in a synchronous converter.

Discussion, pp. 469-480, by Messrs. F. B. Crocker, R. B. Owens, W. E. Goldsborough, Gano S. Dunn and C. P. Steinmetz.

Method of representing armature currents in a synchronous converter. Calculation of voltage ratio of synchronous converters and determination of the armature heating.

F. RESISTORS

A NEW RHEOSTAT

Charles E. Carpenter **Vol. ix—1892, pp. 500-506**

Description of construction of resistor units composed of wire or carbon imbedded zig-zag fashion in insulating material.

Discussion, pp. 506-507, by Messrs. Frank J. Sprague, E. A. Sperry, C. E. Carpenter and F. R. Upton.

10. STEAM BOILERS AND PRIME MOVERS

A THERMO-ELECTRIC METHOD OF STUDYING CYLINDER CONDENSATION IN STEAM ENGINE CYLINDER

Edwin H. Hall Vol. viii—1891, pp. 236-244

Brief outline of indicator card method of studying cylinder condensation, followed by description of construction of thermo-couple, and its application to the study of temperature distribution in the cylinder walls. Observed temperature at different distances back from the interior surface.

Discussion, pp. 244-245, by Messrs. W. J. Hammer, W. E. Geyer, Edw. L. Nichols, and Edwin H. Hall and Geo. G. Geyer.

THE COST OF STEAM POWER PRODUCED WITH ENGINES OF DIFFERENT TYPES UNDER PRACTICAL CONDITIONS, WITH SUPPLEMENT RELATING TO WATER POWER

Charles E. Emery Vol. x—1893, pp. 119-147

Detailed analysis of the cost of developing energy in various types of reciprocating steam engine plants, covering cost of machinery and its installation, and all fixed and operating charges.

Discussion, pp. 148-165 and 484-488, by Messrs. Frank J. Sprague, George Forbes, Samuel McElroy, J. F. Holloway, C. O. Mailloux, Charles E. Emery and L. B. Stillwell.

Figures on the actual cost of old hydraulic developments in New England. General remarks on the cost of hydroelectric plants.

THE VARIATION IN ECONOMY OF THE STEAM ENGINE DUE TO VARIATION IN LOAD

R. C. Carpenter Vol. x—1893, pp. 297-325

Development of method of calculation of steam consumption in any type of steam engine operating under different conditions and at different loads, the steam consumption at most economical load being known. Formulas checked by actual tests on many different types of engines. Data and test results plotted as curves.

Discussion, pp. 326-330, by Messrs. Louis Duncan, R. C. Carpenter, F. A. C. Perrine and Charles E. Emery.

General remarks on Prof. Carpenter's formulas, their usefulness and their limitations.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND

H. Ward Leonard Vol. xii—1895, pp. 36-53

Account of observations of European practice in manufacturing and engineering, synchronous converters, steam engines, Parsons and DeLaval turbines, electric railways, central stations. Description of equipment and mode of operating and tests of Heilman self-contained electric locomotive.

Discussion, pp. 54-77, by Messrs. Townsend Wolcott, John W. Lieb, Jr., Chas. E. Emery, Herbert Lloyd, A. E. Kennelly, Wm. Maver, Jr., M. N. Forney, Cary T. Hutchinson, W. L. Bliss, Richard Fleming, Joseph Sachs, F. B. Crocker, E. J. Houston, H. Ward Leonard, B. J. Arnold, W. M. Stine, C. K. MacFadden, L. L. Summers and A. V. Abbott.

General data on Berlin central stations. Discussion of the Heilman locomotive performance and probable usefulness.

THE COST OF STEAM POWER

Charles E. Emery **Vol. xii—1895, pp. 358-370**

Factors which enter into the cost of electric energy produced from steam. Estimated cost of energy production at various load factors under the most favorable coditions. Analysis of cost of fuel, labor and repairs, showing the effect of various conditions thereon.

Discussion, pp. 371-387, by Messrs. W. A. Anthony, F. B. Crocker, R. W. Pope, Oberlin Smith, C. E. Emery, Joseph Wetzler, Peter Wright, L. B. Stillwell, B. J. Arnold, Harry Alexander, Nelson W. Perry and Allan V. Garratt.

General remarks on cost of producing electric energy and on competition of Niagara Falls electric energy with steam.

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT

Franklin L. Pope **Vol. xii—1895, pp. 454-468**

Description of plant of Great Barrington Electric Light Company, and account of steps taken in remodelling it so as to make it pay. Interesting information on water wheel tests, line construction and street lighting systems.

Discussion, pp. 468-469, by Dr. Chas. E. Emery.

THE COST OF STEAM POWER

Horatio A. Foster **Vol. xiv—1897, pp. 385-415**

Analysis of the cost of energy production from steam engines in a number of plants including central stations, isolated plants and factories.

Discussion, pp. 416-421, by Messrs. F. B. Crocker, F. A. C. Perrine, R. W. Pope, R. B. Owens, Douglass Burnett and W. H. Ripley.

Relative calorific value of different kinds of coal.

AN ECONOMY TEST OF A CENTRAL STATION

W. E. Goldsborough **Vol. xv—1898, pp. 163-227**

Description of the West Pratt Street Station of the Edison Electric Illuminating Company of Baltimore, followed by a complete description of comprehensive economy tests, giving results in the form of tables and charts.

No discussion.

ELEMENTS OF DESIGN FAVORABLE TO SPEED REGULATION IN PLANTS DRIVEN BY WATER POWER

Allan V. Garratt **Vol. xvi—1899, pp. 361-394**

Outline of the fundamental theory of water turbine regulation. The effect of the design of the different elements in a turbine installation upon speed regulation, including penstocks, flumes, draft tubes, turbine gates, fly-wheels, etc.

Discussion, pp. 394-405, by Messrs. C. F. Hopewell, A. V. Garratt, W. S. Aldrich, C. W. Rice, C. P. Steinmetz, Louis Bell, W. E. Goldsborough, H. Ward Leonard, W. J. Hammer and S. L. G. Knox.

General remarks on turbine installation.

11. POWER PLANTS

A. BUILDINGS

CENTRAL STATION CONSTRUCTION

J. A. Powers **Vol. iv—1887, pp. 189-197**

General remarks on the choice of location and building construction of a central station, followed by a detailed description of a 500 h.p. plant at Troy, N. Y., which gives an excellent idea of the best central station practice of the time.

B. ECONOMICS

THE COST OF STEAM POWER

Horatio A. Foster **Vol. xiv—1897, pp. 385-415**

Analysis of the cost of energy production from steam engines in a number of plants including central stations, isolated plants and factories.

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No discussion.

THE COST OF ELECTRICITY IN SOME TYPICAL BUILDINGS IN NEW YORK CITY

Percival R. Moses **Vol. xvi—1899, pp. 305-327**

Discussion of results of an investigation of the relative merits of central stations and isolated plant service in a large number of buildings in New York City.

Discussion, pp. 327-344, by Messrs. H. Ward Leonard, Arthur Williams, P. R. Moses, C. P. Steinmetz, C. W. Rice and Charles Blizard.

Central station versus isolated plant service. Relative costs and other economic features.

C. HYDROELECTRIC PLANTS

LONG-DISTANCE TRANSMISSION AT 10,000 VOLTS

George Herbert Winslow **Vol. xii—1895, pp. 405-432**

Description of the Pomona Plant of the San Antonio Light & Power Company, covering hydraulic equipment for very high head, power plant, transmission line and substation.

No discussion.

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT

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D. STEAM-ELECTRIC PLANTS

THE COST OF STEAM POWER

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Factors which enter into the cost of electric energy produced from steam. Estimated cost of energy production at various load factors under the most favorable conditions. Analysis of cost of fuel, labor and repairs, showing the effect of various conditions thereon.

Discussion, pp. 371-387, by Messrs. W. A. Anthony, F. B. Crocker, R. W. Pope, Oberlin Smith, C. E. Emery, Joseph Wetzler, Peter Wright, L. B. Stillwell, B. J. Arnold, Harry Alexander, Nelson W. Perry and Allan V. Garratt.

General remarks on cost of producing electric energy and on competition of Niagara Falls electric energy with steam.

A MODERN ELECTRIC CENTRAL STATION

George A. Damon Vol. xv—1898, pp. 347-362

Description of the power plant of the Imperial Electric Light, Heat & Power Company, St. Louis, which was equipped with engines and generators coupled according to the Arnold system.

Discussion, p. 362, by Messrs. F. B. Crocker, B. J. Arnold and C. P. Steinmetz.

CONNECTED RAILWAY UNIT AT DIFFERENT LOADS. TEST OF A 300-KILOWATT DIRECT

Edward J. Willis Vol. xvi—1899, pp. 599-603

Tabulated data from a steam electric power plant consisting of water tube boiler, tandem compound condensing engine railway generator.

Discussion, pp. 604-606, by Messrs. A. E. Kennelly, George F. Sever, E. J. Willis, George Hill and C. O. Mailloux.

E. ELECTRIC APPARATUS AND WIRING

LONG DISTANCE TRANSMISSION FOR LIGHTING AND POWER

Charles F. Scott Vol. ix—1892, pp. 425-442

Description of alternating current lighting plants installed by Westinghouse Company at Portland, Ore., and Telluride, Colo.

Discussion, pp. 442-444, by Messrs. H. Ward Leonard, Carl Hering, C. S. Bradley and E. A. Sperry.

STORAGE BATTERY APPLICATIONS

Vol. xii—1895, pp. 585-561

A topical discussion by Messrs. Arthur E. Childs, C. L. Edgar, Nelson W. Perry, Francis B. Crocker, Carl Hering, Frederick Reckenzaun, Townsend Wolcott, H. Ward Leonard, J. B. Entz, J. R. Williams, J. Appleton, Chas. Blizard, E. T. Birdsall, J. W. Lieb, Jr., Arthur V. Abbott and Franz J. Dommerque, Ludwig Gutmann, Mr. Sheehy, M. H. Gerry, Jr., B. J. Arnold, Mr. McFadden, Prof. Carhart, W. M. Stine and Mr. Feldman.

Storage batteries in central stations, covering performance characteristics, economics and experience in various classes of service. Factors which affect the design of batteries for different kinds of service. General discussion of the storage battery situation. Storage battery vs. gas engine for standby service.

THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE

Bion J. Arnold **Vol. xiii—1896, pp. 271-286**

Description of the design and operation of the plant.

Discussion, pp. 286-290, by Messrs. Townsend Wolcott, B. J. Arnold, J. W. Lieb, Jr., E. E. Ries and Douglass Burnett.

12. TRANSMISSION

LONG DISTANCE TRANSMISSION FOR LIGHTING AND POWER

Charles F. Scott **Vol. ix–1892, pp. 425-442**

Description of alternating current lighting plants installed by Westinghouse Company at Portland, Ore., and Telluride, Colo.

Discussion, pp. 442-444, by Messrs. H. Ward Leonard, Carl Hering, C. S. Bradley and E. A. Sperry.

IMPEDANCE

A. E. Kennelly **Vol. x—1893, pp. 175-216**

Development of crank diagram and explanation of the use of vector impedance diagrams. Tables giving impedance factors for iron wires with different currents. Impedance factors of copper wires with different spacing and frequencies from 40 to 140 cycles per second. Appendices: Development of formula for inductance of parallel wires. Measurement of impedance factors for three parallel wires. Analysis of periodic wave into harmonic components.

Discussion, pp. 217-232, by Messrs. W. J. Hammer, Douglass Burnett, T. D. Lockwood, M. I. Pupin, A. E. Kennelly, William E. Geyer, C. S. Bradley, Frank J. Sprague and C. P. Steinmetz.

Explanation of the method of using complex quantities.

PRACTICAL ASPECTS OF LOW FREQUENCY ELECTRICAL RESONANCE

M. I. Pupin **Vol. x—1893, pp. 370-394**

Mechanical analysis of resonance phenomena. Account of experimental study of electrical resonance determining the relation between e. m. f. rise and the various factors of the circuit, bringing out the practical bearing of low-frequency electrical resonance.

Discussion, pp. 395-399, by Messrs. N. Tesla and M. I. Pupin.

Description of thermo-magnetic generator.

RESONANCE IN ALTERNATING CURRENT LINES

E. J. Houston and A. E. Kennelly **Vol. xii—1895, pp. 133-157**

Representation of current and e. m. f. in alternating-current circuits with hyperbolic functions; graphical time-saving method. Theoretical investigation of effects of capacity and inductance upon the transmission characteristics of a given line.

Discussion, pp. 158-169, by Messrs. Charles S. Bradley, M. I. Pupin, Arthur G. Webster, Charles Cuttriss, A. E. Kennelly and William Maver, Jr.

General remarks on the use of hyperbolic functions in alternating-current calculations.

LONG-DISTANCE TRANSMISSION AT 10,000 VOLTS

George Herbert Winslow Vol. xii—1895, pp. 405-432

Description of the Pomona Plant of the San Antonio Light & Power Company, covering hydraulic equipment for very high head, power plant, transmission line and substation.

No discussion.

PRESENT STATUS OF THE TRANSMISSION AND DISTRIBUTION OF ELECTRICAL ENERGY

Louis Duncan Vol. xiii—1896, pp. 295-312

Review of current practice in the design and operation of generating plants, transmission lines and distribution systems for direct current and alternating current, followed by suggestions as to the possible limits of voltage and distance in transmission.

Discussion, pp. 312-323, by Messrs. C. P. Steinmetz, Townsend Wolcott, Robert Lamb, E. E. Ries, N. W. Perry, J. G. White and Louis Duncan.

General remarks on transmission and distribution.

POWER TRANSMISSION AND DISTRIBUTION FOR RAILWAY WORK

Ernst J. Berg Vol. xv—1898, pp. 379-401

Analytical study of the voltage regulation in a railway distribution system, bringing out the effect of circuit constants upon the e. m. f. characteristics of generators and synchronous converters.

No discussion.

HIGH-VOLTAGE POWER TRANSMISSION

Charles F. Scott Vol. xv—1898, pp. 531-576

Account of experience and tests made upon the high-tension system at Telluride. Experience covering insulators, corona loss, transformers and lightning protection. Results of Mershon's tests upon corona losses, together with extensive extracts from his report.

No discussion.

13. ELECTRIC SERVICE DISTURBANCES AND PROTECTION

UNDERGROUND ELECTRICAL SYSTEMS

Sydney F. Shelbourne Vol. iii—1886, pp. 31-48

General discussion of the problems involved in the operation of the electric circuits underground. Description of the properties of various duct materials. Explanation of the relation between specific capacity and insulation materials. Account of troubles with corrosion of lead sheaths. Suggested methods of avoiding inductive disturbances on arc lighting cables and particularly telephone and telegraph lines.

Discussion, pp. 49-66, by Messrs. Frank L. Pope, W. D. Lockwood, T. D. Lockwood, C. O. Mailloux, G. C. Maynard, Sydney F. Shelbourne, ——— Young, Ralph W. Pope and O. E. Michaelis.

Experience with lead covered cables underground. Explanation of the corrosion of lead.

LIGHTNING ARRESTERS AND THE PHOTOGRAPHIC STUDY OF SELF-INDUCTION

F. G. Acheson Vol. vi—1889, pp. 74-98

Experimental study of the effect of discharge of spark gap lightning arresters upon insulation stresses. Investigation of the effects of various arrangements of ground connection. Photographic records of spark discharges under various circuit conditions exposed through revolving perforated disk.

Discussion, pp. 98-106, by Messrs. Otto A. Moses, E. G. Acheson, E. T. Birdsall, Leonidas Le C. Hamilton, Lemuel W. Serrell, Joseph Wetzler, William E. Geyer, Charles Cuttriss, Allan V. Garratt and Holbrook Cushman.

LIGHTNING ARRESTERS AND THE PHOTOGRAPHIC STUDY OF SELF-INDUCTION

Joseph Stanford Brown and Charles T. Child Vol. iv—1889, pp. 135-143

Detailed analysis and criticism of Mr. Acheson's paper. Circuit diagrams redrawn to bring out more clearly the electrical relations. Consideration of the condenser action of the cable upon the spark gap arrester performance.

Discussion, pp. 143-155, by Messrs. J. S. Brown, C. O. Mailloux, Ralph W. Pope and ——— Abdank.

Replies to criticisms of Mr. Acheson's paper.

DISCRIMINATING LIGHTNING ARRESTERS, AND RECENT PROGRESS IN MEANS FOR PROTECTION AGAINST LIGHTNING

Alexander Jay Wurts Vol. xi—1894, pp. 337-377

General requirements of a lightning arrester. Description of multi-gap arrester used with choke coils and account of experiments with 3,000-volt installation. Mode of operation and tests on condenser type and enclosed high resistor type discriminating lightning arrester.

Discussion, pp. 378-405, by Messrs. Joseph Sachs, A. J. Wurts, William

Stanley, Charles Hewitt, W. E. Harrington, A. E. Kennelly, C. P. Steinmetz, W. J. Jenks, A. V. Abbott, Ludwig Gutmann, C. C. Haskins, George M. Mayer and Carl K. MacFadden.

General remarks on lightning protection, arresters and grounded overhead wires. Description of Lodge's experiment on "Recoil Kick." Experience with lightning disturbances.

ALTERNATING CURRENTS AND FUSES

Dugald C. Jackson and R. J. Ochsner **Vol. xi—1894, pp. 430-439**

Experimental investigation of the effects of prolonged application of alternating current to samples of commercial fuse wires.

Discussion, pp. 439-440, by Messrs. Leonard Waldo, J. P. Jackson and David Salomons.

Qualities of ideal fuse metal.

SOME TELEPHONE DISTURBANCES FROM ELECTRICAL GENERATORS

George D. Shepardson **Vol. xv—1898, pp. 443-460**

Account of qualitative investigation of telephone disturbances caused by direct commutation in neighboring systems, Bibliography of telephone line disturbances from other circuits.

No discussion.

THE PROTECTION OF SECONDARY CIRCUITS FROM FIRE RISKS

Cary T. Hutchinson **Vol. xvi—1899, pp. 407-417**

Discussion of various methods of protecting secondary circuits in alternating current distribution system. Recommendation that the Institute pass a resolution favoring permission to ground the neutral of secondary circuits.

Discussion, pp. 417-430, by Messrs. Elihu Thomson, C. M. Goddard, W. E. Goldsborough, C. P. Steinmetz, Louis Bell, James I. Ayer, William Brophy, W. L. Puffer, C. W. Rice, W. J. Hammer and A. E. Kennelly.

Advantages of grounding secondary of distribution system.

14. DISTRIBUTION SYSTEMS

DESCRIPTION OF A LARGE SECONDARY BATTERY PLANT FOR GENERAL COMMERCIAL DISTRIBUTION

E. P. Roberts **Vol. ii—1885, pp. 1-3, paper No. 5**

Brief description of an installation of batteries according to the Brush system for arc lighting, there being a separate battery in each block.

Discussion, pp. 3-20, by Messrs. W. A. Anthony, E. P. Roberts, ——— Hall, F. L. Pope, R. W. Pope, E. P. Thomson, S. F. Shelbourne, Geo. A. Hamilton, ——— Card, H. B. Slater, T. C. Martin, Rowland Hazard and ——— Carey.

Further information concerning the Brush battery system. General remarks on electric lighting.

Vol. iii—1886, pp. 1-6

Discussion of Sidney F. Shelbourne's paper on "Underground Electrical Systems" at Dinner and Special Meeting of the Institute.

UNDERGROUND ELECTRICAL SYSTEMS

Sydney F. Shelbourne **Vol. iii—1886, pp. 31-48**

General discussion of the problems involved in the operation of the electric circuits underground. Description of the properties of various duct materials. Explanation of the relation between specific capacity and insulation quality. Discussion of the qualities of cable insulating materials. Account of troubles with corrosion of lead sheaths. Suggested methods of avoiding inductive disturbances on arc lighting cables and particularly telephone and telegraph lines.

Discussion, pp. 49-66, by Messrs. Frank L. Pope, W. D. Lockwood, T. D. Lockwood, C. O. Mailloux, G. C. Maynard, Sydney F. Shelbourne, ——— Young, Ralph W. Pope and O. E. Michaelis.

Experience with lead covered cables underground. Explanation of the corrosion of lead.

DISTRIBUTION OF ELECTRICITY BY SECONDARY GENERATORS

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Topical discussion by Messrs. Frank L. Pope, Otto A. Moses, O. E. Michaelis, Elihu Thomson, Joseph Wetzler, C. O. Mailloux, ——— Church, Ralph W. Pope, E. E. Ries, ——— Wright, S. S. Wheeler, T. C. Martin and G. W. Mansfield.

General remarks on the alternating current system of electric distribution, covering its merits and characteristics. Experience in operation of such a system. Brief remarks on stationary transformer and account of development of Elihu Thomson's welder. Announcement of Elihu Thomson's self-starting alternating current motor.

STORAGE BATTERIES IN PRACTICE

E. P. Roberts Vol. iv—1887, pp. 128-131

Brief statement of reasons for abandoning the Brush distributing battery system in favor of the central station.

Discussion, pp. 131-137, by Messrs. T. C. Martin, C. O. Mailloux, Joseph Wetzler, ——— Hamilton, Ralph W. Pope, Frank L. Pope and Edward P. Thompson.

General remarks on the storage battery and its uses in lighting and traction.

SOME OBJECTIONS TO THE OVERHEAD CONDUCTOR FOR ELECTRIC RAILWAYS

M. B. Leonard Vol. v—1888, pp. 401-407

Account of experience with the overhead and return distribution system of the Richmond Union Passenger Railway, pointing out the many objections to that type of system.

ELECTRICAL NOTES OF A TRANSATLANTIC TRIP

Thomas E. Lockwood Vol. vi—1889, pp. 411-425

Review of current practice in telegraphy, electric lighting and telephony in England and on the Continent of Europe. Brief mention of some of the Electrical exhibits at the Paris Exposition.

Discussion, pp. 425-439, by Messrs. F. L. Pope, Allen V. Garratt, T. C. Martin and G. L. Addenbrooke.

Additional information on the methods of construction employed in English distribution systems. Electric railways in England.

SOME METHODS OF REGULATING ACCUMULATORS IN ELECTRIC LIGHTING

George B. Prescott, Jr. Vol. vi—1889, pp. 439-475

Discussion of the use of storage batteries in connection with lighting plants to help out the constant load factor and to save distribution copper. Description of typical installation, showing the use of overload circuit breakers and counter e. m. f. cells with the automatic end cell switches. Circuit diagrams.

Discussion, pp. 476-485, by Messrs. George B. Prescott, Jr., Townsend Wolcott, T. C. Martin, John W. Howell, R. W. Pope, Joseph Wetzler and Elihu Thomson.

Description of method of automatically maintaining constant e. m. f. at battery terminals.

THE PRACTICAL WORKING OF THE ELECTRICAL SUBWAYS OF NEW YORK CITY

William Maver, Jr. Vol. vii—1890, pp. 57-95

General review of current practice in the installation and operation of underground electrical circuits in New York City, covering the material and construction of the conduits; the construction, properties and installation of the cables and the operation of the systems.

Discussion, pp. 96-105, by Messrs. Charles Cuttriss; William Mayer, Jr., Edward Lauterbach, Joseph Wetzler, W. J. Hammer, Georges d'Infreville, S. S. Wheeler, Wm. B. Halsey and James H. Seymour.

General remarks on the electrical distribution situation in New York City, with special reference to its political aspects.

SOME TESTS ON THE EFFICIENCY OF ALTERNATING-CURRENT APPARATUS

Louis Duncan and W. F. C. Hasson Vol. vii—1890, pp. 109-117

Brief description of the efficiency test made on 750-lamp Westinghouse a. c. generator and distribution transformers. Discussion of effect of all-day efficiency upon system using large number of small transformers.

Discussion, pp. 118-127, by Messrs. W. A. Anthony, Nikola Tesla, H. Ward Leonard, S. S. Wheeler, Louis Duncan, O. T. Crosby, Frederick Darlington, John Millis, Townsend Wolcott, M. I. Pupin and J. B. Entz.

General remarks on transformer design. Comparative efficiency of direct-current with alternating-current distribution system.

THE INDUSTRIAL UTILIZATION OF THE COUNTER-ELECTROMOTIVE FORCE OF SELF INDUCTION

Thomas D. Lockwood Vol. vii—1890, pp. 226-243

Outline of discovery and development of the uses of counter e. m. f. of self-inductance. Citing references to original articles and patents covering applications of counter e. m. f. of inductance in telephone, telegraph and lighting circuits.

No discussion.

SOME POSSIBLE MODIFICATIONS IN THE METHODS OF PROTECTING BUILDINGS FROM LIGHTNING

N. D. C. Hodges Vol. viii—1891, pp. 159-167

Discussion of lightning phenomena based upon the writings of early scientists. Presentation of a method of protection by providing conductors with small cross section, which will be exploded by conduction of lightning discharge and thus harmlessly dissipate the energy.

Discussion, pp. 167-175, by Messrs. Edw. P. Thompson, Wm. E. Geyer, Townsend Wolcott, N. D. C. Hodges. Chas. Steinmetz, E. T. Birdsall and James Hamblet.

General remarks on the nature of lightning discharges. Explanation of the beneficial effect of high resistance lightning conductor.

A NEW GRAPHICAL METHOD OF CALCULATING LEADS FOR WIRING

Carl Hering Vol. viii—1891, pp. 227-233

Theory, construction and method of using a universal graphical wiring chart. Reproduction of chart.

Discussion, pp. 233-235, by Messrs. F. A. C. Perrine, W. J. Hammer, C. O. Mailloux and Carl Hering.

Reference to other similar charts.

LIGHTNING ARRESTERS, AND THE DISCOVERY OF NON-ARCING METALS

Alexander J. Wurts Vol. ix—1892, pp. 102-120

Account of experimental investigation with lightning arresters which resulted in the discovery of non-arcing metals and the development of lightning arresters based on this discovery.

Discussion, pp. 120-133, by Messrs. Thomas D. Lockwood, Charles E. Emery, A. J. Wurts, George B. Prescott, Jr., Joseph Wetzler, E. P. Thompson, E. E. Geyer, E. T. Birdsall, M. C. Sullivan, A. E. Kennelly and R. W. Pope.

General remarks on lightning protection and lightning arresters. Protection of telegraph lines.

SOME FEATURES OF ALTERNATING CURRENT SYSTEMS

Charles P. Steinmetz Vol. xii—1895, pp. 326-349

Analytical study of power characteristics of single and polyphase circuits, leading up to the development of the monocyclic system of operation. Description of the monocyclic motor.

No discussion.

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT

Franklin L. Pope Vol. xii—1895, pp. 454-468

Description of plant of Great Barrington Electric Light Company, and account of steps taken in remodeling it so as to make it pay. Interesting information on water wheel tests, line construction and street lighting systems.

Discussion, pp. 468-469, by Dr. Chas. E. Emery.

EXISTING COMMERCIAL APPLICATIONS OF ELECTRICAL POWER FROM NIAGARA FALLS

W. L. R. Emmet Vol. xii—1895, pp. 482-492

Description of substation apparatus of Pittsburg Reduction Company and the Carborundum Company for transforming alternating current to direct current.

Discussion, pp. 492-499, by Messrs. Jules Neher, W. L. R. Emmet, Charles P. Steinmetz and L. B. Stillwell.

Factors entering into the design of synchronous converters for large current values.

PRESENT STATUS OF THE TRANSMISSION AND DISTRIBUTION OF ELECTRICAL ENERGY

Louis Duncan Vol. xiii—1896, pp. 295-312

Review of current practice in the design and operation of generating plants, transmission lines and distribution systems for direct current and alternating current, followed by suggestions as to the possible limits of voltage and distance in transmission.

Discussion, pp. 312-323, by Messrs. C. P. Steinmetz, Townsend Wolcott, Robert Lamb, E. E. Ries, N. W. Perry, J. G. White and Louis Duncan.

General remarks on transmission and distribution.

ELECTRIC TRACTION

M. H. Gerry, Jr. Vol. xiv—1897, pp. 353-375

Description of equipment of the Metropolitan Elevated Railroad, Chicago, followed by tests of the power requirements of trains. Train resistance, speed-time and motor performance curves. Efficiency of straight direct current distribution system at different loads.

Discussion, pp. 376-383, by Messrs. F. B. Crocker, F. A. C. Perrine, R. W. Pope, Elihu Thomson, Gano S. Dunn and C. P. Steinmetz.

Effect of train acceleration upon energy requirements.

POWER TRANSMISSION AND DISTRIBUTION FOR RAILWAY WORK

Ernst J. Berg Vol. xv—1898, pp. 379-401

Analytical study of the voltage regulation in a railway distribution system, bringing out the effect of circuit constants upon the e. m. f. characteristics of generators and synchronous converters.

No discussion.

SOME TELEPHONE DISTURBANCES FROM ELECTRICAL GENERATORS

George D. Shepardson Vol. xv—1898, pp. 443-460

Account of qualitative investigation of telephone disturbances caused by direct commutation in neighboring systems. Bibliography of telephone line disturbances from other circuits.

No discussion.

ALTERNATING CURRENT TRANSFORMERS-FROM THE STATION MANAGER'S VIEWPOINT

W. F. White Vol. xv—1898, pp. 505-514

Presentation of the advantages of a single large transformer over a number of smaller ones. Experience as to the actual savings in favor of the single transformer.

No discussion.

AN ECONOMY TEST OF A CENTRAL STATION

W. E. Goldsborough Vol. xv—1898, pp. 163-227

Description of the West Pratt Street Station of the Edison Electric Illuminating Company of Baltimore, followed by a complete description of comprehensive economy, tests, giving results in the form of tables and charts.

No discussion.

TWO WIRE DISTRIBUTING SYSTEMS AND LAMPS, 200-240 VOLTS

John W. Howell Vol. xv—1898, pp. 331-336

Discussion of the advantages of 240-volt two wire system as compared with 120-volt three wire system.

Discussion, pp. 336, by Messrs. G. D. Shepardson and H. H. Humphrey.

THE PROTECTION OF SECONDARY CIRCUITS FROM FIRE RISKS

Cary T. Hutchinson Vol. xvi—1899, pp. 407-417

Discussion of various methods of protecting secondary circuits in alternating current distribution system. Recommendation that the Institute pass a resolution favoring permission to ground the neutral of secondary circuits.

Discussion, pp. 417-430, by Messrs. Elihu Thomson, C. M. Goddard, W. E. Goldsborough, C. P. Steinmetz, Louis Bell, James I. Ayer, William Brophy, W. L. Puffer, C. W. Ries, W. J. Hammer and A. E. Kennelly.

Advantages of grounding secondary of distribution system.

15. CONTROL, REGULATION AND SWITCHING

ELECTRIC MOTOR REGULATION

Francis B. Crocker Vol. iv—1889, pp. 237-252

Comprehensive review of different methods of regulating the speed of direct current motors for operation with constant e. m. f. and with constant current. Circuit diagrams.

Discussion, pp. 252-263, by Messrs. Townsend Wolcott, Francis B. Crocker, Edward Weston, S. S. Wheeler, Joseph Wetzler, C. O. Mailloux, E. P. Roberts, E. L. Nichols and Elihu Thomson.

General remarks on speed control of d. c. motors. Suggested control by periodically short circuiting field winding and varying the period. Methods of controlling constant current motors.

SOME METHODS OF REGULATING ACCUMULATORS IN ELECTRIC LIGHTING

George B. Prescott, Jr. Vol. iv—1889, pp. 439-475

Discussion of the uses of storage batteries in connection with lighting plants to help out the constant load factor and to save distribution copper. Description of typical installation, showing the use of overload and underload circuit breakers and counter e. m. f. cells with automatic end cell switches. Circuit diagrams.

Discussion, pp. 476-485, by Messrs. George B. Prescott, Jr., Townsend Wolcott, T. C. Martin, John W. Howell, R. W. Pope, Joseph Wetzler and Elihu Thomson.

Description of method of automatically maintaining constant e. m. f. at battery terminals.

METHODS OF ELECTRICALLY CONTROLLING STREET CAR MOTORS

H. F. Parshall Vol. ix—1892, pp. 137-149

Description of series parallel platform controller and rheostat. Construction drawings.

Discussion, pp. 149-166, by Messrs. Thomas D. Lockwood, Charles Hewitt, Townsend Wolcott, Charles P. Steinmetz, Thorburn Reid, C. G. Curtis, F. B. Crocker and D. C. Jackson.

Relative advantages and efficiency of various types of motor connections. Eickemeyer railroad motor.

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Speed Regulation of Electric Motors

H. Ward Leonard Vol. xiii—1896, pp. 377-386

Description of various e. m. f. systems of motor speed control invented by the author.

Discussion, pp. 387-399, by Messrs. G. S. Dunn, C. T. Hutchinson, F. A. Pattison, James Burke, C. P. Steinmetz, R. T. Lozier, William Elmer, Jr., H. Ward Leonard and E. R. Carichoff.

General remarks on the efficiency and economics of the Ward Leonard system of motor control.

ELEMENTS OF DESIGN FAVORABLE TO SPEED REGULATION IN PLANTS DRIVEN BY WATER POWER

Allan V. Garratt **Vol. xvi—1899, pp. 361-394**

Outline of the fundamental theory of water turbine regulation. Consideration of the effect of the design of the different elements in a turbine installation upon speed regulation, including penstocks, flumes, draft tubes, turbine gates, fly-wheels, etc.

Discussion, pp. 395-405, by Messrs. C. F. Hopewell, A. V. Garratt, W. S. Aldrich, C. W. Rice, C. P. Steinmetz, Louis Bell, W. E. Goldsborough, H. Ward Leonard, W. J. Hammer and S. L. G. Knox.

General remarks on turbine installation.

MOTOR SPEED REGULATION

Alton D. Adams **Vol. xvi—1899, pp. 443-445**

Attention called to inefficiency of armature resistance method and desirability of controlling the speed by varying the strength of magnetic field.

Discussion, pp. 446-447, by Messrs. J. B. Blood and C. A. Adams.

Advantages of e m. f. method of speed control.

16. TRACTION

A. RAILWAY SYSTEMS

THE SCIENTIFIC CITY STREET

Rowland R. Hazard Vol. i—1884, pp. 1-6, paper No. 6

Description of a proposed subway construction for Broadway, New York, involving tunnels for express and local train service and of public utilities such as gas, electricity, water, telephone, telegraph, etc.

ELECTRIC STREET CARS

T. C. Martin Vol. iv—1887, pp. 26-38

General discussion of the disadvantages of animal power and cable power for street railways, followed by description of the Daft third rail, the Van Depoele overhead trolley and the underground conduit railway systems. Cost, operation maintenance and efficiency of electric system compared with older forms of motive power.

Discussion, pp. 38-57, by Messrs. O. E. Michaelis, Jno. M. Mitchell, Joseph Wetzler, Van Depoele, C. O. Mailloux, G. W. Mansfield, S. D. Field, J. M. Pendleton, ——— Stiles, T. C. Martin and R. M. Hunter.

Experience with different systems of electric propulsion of railway cars. Methods of connecting motor to driving axles. Brief description of Daft, Van Depoele, Julien, Field and Pendleton systems of electric traction.

A FEW COMPARATIVE STATISTICS OF ELECTRIC RAILWAYS

T. Commerford Martin Vol. iv—1887, pp. 183-187

Tables giving location, equipment, cost of operation, service, etc., of European and American railways.

Discussion, pp. 188-189, by Messrs. Sidney F. Shelbourne, Frank L. Pope, T. Commerford Martin and J. A. Powers.

THE SOLUTION OF MUNICIPAL RAPID TRANSIT

Frank J. Sprague Vol. v—1888, pp. 351-398

Discussion of the disadvantages of horse and cable traction and the advantages of electric traction. Method of determining the motor rating necessary for a given service. Description of the system and equipment of the Richmond Union Passenger Railway. Account of experiments in its early operation. Itemized cost of operation. Consideration of the rapid transit problem in New York. Brief review of several of the proposed plans and outline of comprehensive system proposed by the author. Discussion of methods of electric braking motors operating as generators.

Discussion, pp. 398-399, by Messrs. Edward O. Weston and Frank J. Sprague.

Further discussion incorporated with that of paper by Almon Robinson on "Note on Gearing for Electric Railway motors."

NOTE ON GEARING FOR ELECTRIC RAILWAY MOTORS

Almon Robinson **Vol. v—1888, pp. 408-410**

General suggestion that variable speed of mechanical transmission will be desirable.

Discussion (including that of paper by Frank J. Sprague on "The Solution of Municipal Rapid Transit"), pp. 410-435, by Messrs. Elias E. Ries, J. M. Pendleton, C. O. Mailloux, S. S. Wheeler, Frank J. Sprague, L. F. Lyne, David E. Lain, M. B. Leonard, Thomas Whiteside Rae and Charles E. Emery.

Comparative merits of feeding regenerated energy into the line and into storage batteries. Independently driven axles vs. group drive axles. Disadvantages of rail return circuit. Construction of Sprague railway motor. Advantages of the overhead wire with rail return.

SOME RECENT ELECTRICAL WORK ON THE ELEVATED RAILROADS AND ITS BEARING ON THE RAPID TRANSIT PROBLEM

Leo Daft **Vol. vi—1889, pp. 359-378**

Discussion of superiority of adhesive power of electric locomotive over steam due to effect of current at contact between wheel and rail. Account of service tests with electric locomotive ("Ben Franklin") on North Avenue Elevated lines, giving power, time and speed-time curves and profile of the road.

Discussion, pp. 378-387, by Messrs. Charles G. Curtis, Leo Daft, Francis R. Upton, Joseph Wetzler, W. A. Anthony, C. O. Mailloux and T. C. Martin.

MAGNETIC DATA OF THE SPRAGUE STREET CAR MOTOR

H. F. Parshall **Vol. vii—1890, pp. 218-224**

Construction of the magnetic circuit. Magnetic leakage factors for different parts of the circuit. Magnetization characteristics under various conditions of magnetic circuit.

Discussion, p. 225, by Louis Bell.

REPORT OF HIGH-SPEED ELECTRIC RAILWAY WORK

O. T. Crosby **Vol. viii—1891, pp. 57-76**

Description of an experimental automatic electric railway intended for rapid transportation of parcels. Account of experiments, power requirements, train resistance, etc., for speeds up to 100 miles per hour. Description of detailed plan for high-speed (150 miles per hour) interurban railway system, with working drawings of gearless motors and their mode of suspension. Commercial aspects of such a system between New York and Chicago.

Discussion, pp. 76-92, by Messrs. W. A. Anthony, W. H. Peirce, O. T. Crosby, F. L. Pope, Thos. D. Lockwood, Edw. P. Thompson, L. H. Landy, P. H. Dudley, Geo. B. Prescott, Jr., Wm. E. Geyer, Frank J. Sprague and J. Stanford Brown.

Train resistance. General results of studies of track conditions of steam railroad with Dudley dynagraph car. Effect of rail stiffness on train resistance.

CONSIDERATIONS WHICH SHOULD GOVERN THE SELECTION OF A RAPID TRANSIT SYSTEM

Frank J. Sprague Vol. viii—1891, pp. 331-346

Analytical discussion of the rapid transit problem facing the Rapid Transit Commission of New York. Consideration of different possible systems and recommendation of underground road with electric motive power.

Discussion, pp. 347-350, by Messrs. Thomas D. Lockwood, C. O. Mailloux and Geo. Forbes.

Conditions governing the construction of street railways in England. Experience of the South London Railway with electric traction.

METHODS OF ELECTRICALLY CONTROLLING STREET CAR MOTORS

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Description of series parallel platform controller and rheostat. Construction drawings.

Discussion, pp. 149-166, by Messrs. Thomas D. Lockwood, Charles Hewitt, Townsend Wolcott, Charles P. Steinmetz, Thorburn Reid, C. G. Curtis, F. B. Crocker and D. C. Jackson.

Relative advantages and efficiency of various types of motor connection. Eickemeyer railroad motor.

COMING DEVELOPMENT OF ELECTRIC RAILWAYS

Presidential Address

Frank J. Sprague Vol. ix—1892, pp. 229-249

Brief review of current practice of steam roads and possibilities of introduction of electromotive power in these systems.

No discussion.

SERIES ELECTRIC TRACTION

Nelson W. Perry Vol. ix—1892, pp. 547-565

Brief review of the advantages of the series system of distribution. Description of a proposed system of series distribution for electric railways, followed by a statement of the theoretical economies incidental to its use.

Discussion, incorporated with that of paper by Messrs. George D. Shepardson and Edward P. Burch on "Electric Railway Motor Tests."

A NEW SYSTEM OF ELECTRIC PROPULSION

H. Ward Leonard Vol. ix—1892, pp. 566-577

General description of Ward Leonard system of railway motor control by means of motor generator set. Advantages claimed for this system over previous methods, together with comparison of estimated costs of equipment and operation.

Discussion, incorporated with that of paper by Messrs. George D. Shepardson and Edward P. Burch on "Electric Railway Motor Tests."

ELECTRIC RAILWAY MOTOR TESTS

George B. Shepardson and Edward P. Burch Vol. ix—1892, pp. 578-53

Performance tests of Sprague and Thomson-Houston motors. Current and power consumption tests of cars on Minneapolis street railway.

Discussion (including that of paper by N. W. Perry on "Series Electric Traction" and paper by H. Ward Leonard on "A New System of Electric Propulsion"), pp. 595-600 and 761-793, by Messrs. Frank J. Sprague, C. E. Emery, C. S. Bradley, E. F. Thomas, H. Ward Leonard, C. T. Hutchinson, C. O. Mailloux, F. B. Crocker, Charles Hewitt and F. V. Henshaw.

General remarks on the relative efficiency of different types of railway motor control, including commutated fields, rheostat and Ward Leonard system.

HOW SHALL WE OPERATE AN ELECTRIC RAILWAY EXTENDING ONE HUNDRED MILES FROM THE POWER STATION

H. Ward Leonard Vol. xi—1894, pp. 76-84

Description of the Ward Leonard single-phase railway system using single-phase transmission, synchronous motor direct-current generator on the car and direct-current traction motors. Explanation of working model.

Discussion, pp. 84-107, by Messrs. Charles G. Curtis, H. Ward Leonard, C. O. Mailloux, Nelson W. Perry, George Hill, Charles Hewitt, A. E. Kennelly, Wm. Elmer, Jr., C. J. Field, C. J. H. Woodbury, Joseph Sachs, R. N. Baylis and George P. Low.

Further explanation of the mode of operation of the Ward Leonard system. Experience with same system of control on hoists and printing presses.

THE ELECTRIC BRAKE IN PRACTICE

Elmer A. Sperry Vol. xi—1894, pp. 682-709

Description of the construction and operative performance of electric disk brake designed by author. Performance tests of hand and electric brakes.

Discussion, pp. 710-728, by Messrs. Edwin J. Houston, Joseph Wetzler, Elmer A. Sperry, C. S. Bradley, W. J. Hammer, Ralph W. Pope, Joseph Sachs, Max Osterberg, Robert McA. Lloyd, Frankland Jannus, E. A. Merrill, W. E. Harrington, Carl Kammeyer, L. H. Rogers, Mr. Grier, B. J. Arnold, Edward Caldwell, W. M. Stine, Elbert F. Norton and Walter Lobach.

Additional data on performance of Sperry electric brake.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND

H. Ward Leonard Vol. xii—1895, pp. 36-53

Account of observations of European practice in manufacturing and engineering, synchronous converters, steam engines, Parsons and DeLaval turbines, electric railways, central stations. Description of equipment and mode of operating and tests of Heilman self-contained electric locomotive.

Discussion, pp. 54-77, by Messrs. Townsend Wolcott, John W. Lieb, Jr., Chas. E. Emery, Herbert Lloyd, A. E. Kennelly, Wm. Mayer, Jr., M. N. Forney, Cary T. Hutchinson, W. L. Bliss, Richard Fleming, Joseph Sachs, F. B. Crocker, E. J. Houston, H. Ward Leonard, B. J. Arnold, W. M. Stine, C. K. MacFadden, L. L. Summers and A. V. Abbott.

General data on Berlin central stations. Discussion of the Heilman locomotive performance and probable usefulness.

THE SUBSTITUTION OF ELECTRICITY FOR STEAM IN RAILWAY PRACTICE

Louis Duncan **Vol. xii—1895, pp. 268-280**

Analysis of steam road, freight and passenger conditions with reference to the economic advantages of adopting electric motive power. Description of Baltimore & Ohio electric power plant, distribution system and locomotive.

Discussion, pp. 280-287, by Messrs. Charles P. Steinmetz, Oberlin Smith and Louis Duncan.

Analysis of characteristics of electric railway system now in use. Description of three-phase induction motor equipment with concatenated control. Performance tests.

ELECTRIC TRACTION UNDER STEAM RAILWAY CONDITIONS

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Topical discussion, by Messrs. Charles E. Emery, Charles K. Stearns, Charles H. Davis, H. Ward Leonard, George S. Strong, A. E. Kennelly, C. F. Ueberlacker, E. E. Ries, F. W. Darlington, H. M. Brinckerhoff, W. M. Stine, M. Coster, W. D. Ball, J. R. Cravath, C. L. Brown, F. C. Drake and ——— Rugg.

General remarks on the problems in the design of electric railways. Experience with existing electric railways, and comparison of electric with steam motive power.

ELECTRIC TRACTION

M. H. Gerry, Jr. **Vol. xiv—1897, pp. 353-375**

Description of equipment of the Metropolitan Elevated Railroad, Chicago, followed by tests of the power requirements of trains. Train resistance, speed-time and motor performance curves. Efficiency of straight direct current distribution system at different loads.

Discussion, pp. 376-383, by Messrs. F. B. Crocker, F. A. C. Perrine, R. W. Pope, Elihu Thomson, Gano S. Dunn and C. P. Steinmetz.

Effect of train acceleration upon energy requirements.

POWER TRANSMISSION AND DISTRIBUTION FOR RAILWAY WORK

Ernst J. Berg **Vol. xv—1898, pp. 379-401**

Analytical study of the voltage regulation in a railway distribution system, bringing out the effect of circuit constants upon the e. m. f. characteristics of generators and synchronous converters.

No discussion.

THE MULTIPLE UNIT SYSTEM OF ELECTRIC RAILWAYS

Frank J. Sprague Vol. xvi—1899, pp. 193-231

Brief résumé of the evolution of electric railways leading up to multiple unit system of train operation and dwelling upon the advantages of that system. Description of the equipment and operation of the South Side Elevated of Chicago which is equipped with third rail distribution for multiple unit trains.

Discussion, pp. 231-250, by Messrs. J. B. Blood, F. J. Sprague, F. V. Henshaw, C. W. Rice, H. Ward Leonard and A. H. Armstrong.

Relative merits of locomotive and multiple unit systems of train operation Chronological list of achievements in evolution of electric railways.

B. TRAIN MOVEMENT AND MOTOR CAPACITY

ON ELECTRIC STREET CARS WITH SPECIAL REFERENCE TO METHODS OF GEARING CARS

A. Reckenzaun Vol. v—1888, pp. 1-15

Results of tests on Frankfort Electric Railway, giving cost of operation, energy consumption and train resistance. Description and discussion of relative merits of different types of mechanical transmission between motor and driving axles—steel rope, chain, belts, spur gears, friction gears and worm gears.

Discussion, pp. 15-32, by Messrs. Ralph W. Pope, A. Reckenzaun, Jos. Wetzler, C. O. Mailloux, S. S. Wheeler, J. M. Pendleton, T. C. Martin, W. M. Schlessinger, O. E. Michaelis and James D. Reid.

Accounts of experiences with various types of gearing.

THE LIMITATIONS OF STEAM AND ELECTRICITY IN TRANSPORTATION

O. T. Crosby Vol. vii—1890, pp. 265-283

Discussion of the relative cost of train propulsion by steam and electricity. Advantages of high speed for electric propulsion. Train resistance at high speeds.

Discussion, pp. 283-286, by Messrs. Louis Bell, F. L. Pope, O. T. Crosby, Elihu Thomson, Joseph A. Miller and W. L. Hooper.

Gearing loss, air resistance.

ELECTRIC RAILWAY MOTOR TESTS

George B. Shepardson and Edward P. Burch Vol. ix—1892, pp. 578-593

Performance tests of Sprague and Thomson-Houston motors. Current and power consumption tests of cars on Minneapolis street railway.

Discussion (including that of paper by N. W. Perry on "Series Electric Traction" and paper by H. Ward Leonard on "A New System of Electric Propulsion"), pp. 595-600 and 761-793, by Messrs. Frank J. Sprague, C. E. Emery, C. S. Bradley, E. F. Thomas, H. Ward Leonard, C. T. Hutchinson, C. O. Mailloux, F. B. Crocker, Charles Hewitt and F. V. Henshaw.

General remarks on the relative efficiency of different types of railway motor control, including commutated fields, rheostat and Ward Leonard system.

SOME PHASES OF THE RAPID TRANSIT PROBLEM

Albert H. Armstrong Vol. xv—1898, pp. 362-378

General investigation of train acceleration problems by straight line speed-time curves.

No discussion.

C. DISTRIBUTION SYSTEM

SOME OBJECTIONS TO THE OVERHEAD CONDUCTOR FOR ELECTRIC RAILWAYS

M. B. Leonard Vol. v—1888, pp. 401-407

Account of experience with the overhead and return distribution system of the Richmond Union Passenger Railway, pointing out the many objections to that type of system.

THE PRACTICABILITY OF ELECTRIC CONDUIT RAILWAYS

Albert Stetson Vol. x—1893, pp. 630-655

Description of different types of conduit systems in actual use—Bentley-Knight, Love, Buda-Pesth, also of Pollak surface contact. Detailed description of surface contact system devised by author.

Discussion, pp. 656-664, by Messrs. Nelson W. Perry, Albert Stetson, Charles Hewitt, Joseph Sachs, F. A. Scheffler and W. T. M. Mottram.

General remarks on surface contact system of electric car propulsion.

DESTRUCTIVE EFFECT OF ELECTRICAL CURRENTS ON SUBTERRANEAN METAL PIPES

Isaiah H. Farnham Vol. xi—1894, pp. 191-213

Description of the electrolysis situation in Boston, giving various proposed remedies considered and results attained with those adopted. Corrosion and potential exploration tests. General conclusion regarding electrolysis from stray currents from electric railways.

Discussion, pp. 214-245, by Messrs. Geo. W. Plympton, Townsend Wolcott, A. E. Kennelly, I. H. Farnham, Thomas D. Lockwood, Leonard Waldo, Chas. E. Emery, Elihu Thomson, Hermann Lemp, Jr., B. J. Arnold, A. T. Welles, W. M. Stine, Paul Biefeld and Fred D. Silber, C. G. Armstrong and A. V. Abbott.

General discussion of electrolysis from stray currents, covering experience in various cities and proposed remedies.

RAIL-BONDING, AND ITS BEARING ON ELECTROLYTIC CORROSION

George P. Low Vol. xi—1894, pp. 857-872

Account of bad case of electrolysis from stray currents. List of causes of electrolysis, of preventive measures and of the requirements of good return circuit.

No discussion.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN, NEW YORK CITY

A. A. Knudson Vol. xv—1898, pp. 613-631

Measurements of potential distribution between electric railways, pipes and foundations of Brooklyn Bridge. Examples of corrosion of rails and tie-rods due to stray currents.

Discussion, pp. 632-636, by Messrs. William Maver, Jr., A. C. Peckham, A. A. Knudson, Thatcher T. P. Luquer, Jesse M. Smith and Townsend Wolcott.

D. OPERATION

THE ELECTRIC LIGHTING OF PASSENGER TRAINS

George W. Blodgett Vol. iv—1887, pp. 206-214

General discussion of the various methods of train lighting, with description of typical installations, giving cost and operation data.

Discussion, pp. 214-232, by Messrs. Ralph W. Pope, T. C. Martin, Geo. W. Blodgett, ——— Phelps, E. E. Ries, ——— Bracken, Thos. D Lockwood, C. O. Mailloux, Joseph Wetzler and J. M. Pendleton.

General remarks on electric train lighting with special reference to the use of storage batteries. Actual cost figures.

RAILWAY TRAIN LIGHTING

A. H. Bauer Vol. ix—1892, pp. 445-457

Brief résumé of early electric train lighting equipments, followed by description of system using special engine-driven generator installed in baggage car.

Discussion, pp. 457-459, by Messrs. C. R. Gilman, H. Ward Leonard, E. G. Willyoung, E. A. Sperry, Carl Hering, George D. Shepardson and C. F. Street.

E. INDUSTRIAL LOCOMOTIVES

ELECTRICITY IN BITUMINOUS MINING

Elmer A. Sperry Vol. ix—1892, pp. 375-400

Brief résumé of the early mechanical methods of working mines. Description of electric drills, cutters, hoisting machinery and locomotives for use in coal mining.

Discussion, pp. 400-406, by Messrs. Frank J. Sprague, C. E. Emery, N. W. Perry, E. A. Sperry and H. Ward Leonard.

Experience with mining locomotives

F. AUTOMOBILES

ELECTRICALLY DRIVEN VEHICLES

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A topical discussion by Messrs. Andrew L. Riker, Louis Duncan, F.

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Merits of electric vehicles over gas and steam Design of electric vehicles and experience in their operation.

THE DEVELOPMENT OF ELECTRIC CABLEWAYS

Richard Lamb **Vol. xiv—1897, pp. 549-564**

Description of Lamb system of electric tractors for cableway hauling, with account of experience with different installations.

Discussion, pp. 565-578, by Messrs. F. B. Crocker, Townsend Wolcott, Richard Lamb, Charles P. Steinmetz, Joseph Bijur, T. C. Martin, Joseph Sachs, E. E. Ries, C. O. Mailloux, H. Ward Leonard, A. E. Kennelly and P. G. Burton.

OPERATING COSTS OF HORSE AND ELECTRIC DELIVERY WAGONS IN NEW YORK CITY

G. F. Sever and R. A. Fliess **Vol. xvi—1899, pp. 485-507**

Analysis of actual cost of department store delivery by horse method and by electric vehicle. Comparative first cost and cost of operation of the two methods.

Discussion, incorporated with that of paper by Elmer A. Sperry on "Electric Automobiles."

ELECTRIC AUTOMOBILES

Elmer A. Sperry **Vol. xvi—1899, pp. 509-525**

Account of some of the difficulties met with in the design of electric vehicles. Description of Sperry combined steering wheel and controller. Photographs of electric carriages.

Discussion including that of paper by G. F. Sever and R. A. Fliess on "Operating Costs of Horse and Electric Delivery Wagons in New York City"), pp. 525-527, by Messrs. Hermann Lemp, Jr., C. W. Rice, Elmer A. Sperry, J. B. Blood and Elihu Thomson.

17. LIGHTING AND LAMPS

A. LIGHT MEASUREMENT AND UNITS

THE PERSONAL ERROR IN PHOTOMETRY

Edward L. Nichols — **Vol. vi—1889, pp. 335-341**

Experimental investigation of personal error in measurements with Bunsen voltameter.

No discussion.

NOTE ON A NEW PHOTOMETER

Edward L. Nichols — **Vol. vii—1890, pp. 257-262**

Description of horizontal slip spectro-photometer with results of tests showing probable error in photometry of colored light.

Discussion, pp. 263-264, by Messrs. F. A. C. Perrine, Edward L. Nichols and Elihu Thomson.

ON THE UNITS OF LIGHT AND RADIATION

A. Macfarlane — **Vol. xii—1895, pp. 3-8**

Discussion of various light units proposed by different scientists and engineers. Definition of various units.

Discussion, pp. 8-17, by Messrs. A. E. Kennelly, Townsend Wolcott, Douglass Burnett, Clayton H. Sharp and W. M. Stine.

General remarks on lighting units.

REPORT ON PRIMARY AND SECONDARY PHOTOMETRIC STANDARD. THE ACETYLENE AND PRIMARY STANDARDS

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A NEW METHOD OF STUDYING THE LIGHT OF ALTERNATING ARC LAMPS

William L. Puffer — **Vol. xiii—1896, pp. 71-78**

Description of stroboscopic investigation of electric arcs.

No discussion.

STANDARDS OF LIGHT

Preliminary Report of the Sub-Committee of the Institute

Edward L. Nichols, Clayton H. Sharp, and Charles P. Matthews — **Vol. xiii—1896, pp. 133-198**

Account of the investigations of various standards of light, giving the relative merits and characteristics of the different types of lamps and candles.

Discussion, pp. 198-205, by Messrs. Louis Duncan, J. W. Howell, E. L. Nichols, Carl Hering, C. P. Steinmetz and R. A. Fessenden.

REPORT OF COMMITTEE OF UNITS AND STANDARDS, RECOMMENDING THE ADOPTION OF THE HEFNER-ALTENECK LAMP AND THE LUMMER-BRODHUN PHOTOMETER SCREEN

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PLEA FOR A WORKING STANDARD OF LIGHT

S. Everett Doane Vol. xvi—1899, pp. 431-433

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Suitability of incandescent carbon filament as secondary standard. Recommendations for primary and secondary standards of light.

B. LIGHTING

COST OF MINE LIGHTING

F. P. Mills Vol. ii—1885, pp. 1-5, paper No. 3

Description of arc lighting installation, with detailed cost of operation and maintenance of the electrical plant.

Discussion, pp. 5-6, by Messrs. E. P. Roberts, T. C. Martin, Sydney F. Shelbourne and E. P. Thompson.

THE ELECTRIC LIGHTING OF PASSENGER TRAINS

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SOME METHODS OF REGULATING ACCUMULATORS IN ELECTRIC LIGHTING

George B. Prescott, Jr. Vol. vi—1889, pp. 439-475

Discussion of the use of storage batteries in connection with lighting plants to help out the constant load factor and to save distribution copper. Description of typical installation, showing the use of overload circuit breakers and counter e. m. f. cells with the automatic end cell switches. Circuit diagrams.

Discussion, pp. 476-485, by Messrs. George B. Prescott, Jr., Townsend Wolcott, T. C. Martin, John W. Howell, R. W. Pope, Joseph Wetzler and Elihu Thomson.

Description of method of automatically maintaining constant e. m. f. at battery terminals.

ELECTRIC LIGHTING IN THE TROPICS

Wilfred H. Fleming Vol. vii—1890, pp. 168-174

Outline of electric lighting practice in the East and West Indies, covering the peculiar conditions that influence construction and operation.

No discussion.

THE INDUSTRIAL UTILIZATION OF THE COUNTER-ELECTROMOTIVE FORCE OF SELF INDUCTION

Thomas D. Lockwood Vol. vii—1890, pp. 226-243

Outline of discovery and development of the uses of counter e. m. f. of self-inductance. Citing references to original articles and patents covering applications of counter e. m. f. of inductance in telephone, telegraph and lighting circuits.

No discussion.

INVESTIGATION OF THE STANLEY ALTERNATE CURRENT ARC DYNAMO

W. B. Tobey and G. B. Walbridge Vol. vii—1890, pp. 367-378

Description of the Stanley arc generator and of performance tests at different loads. Curves of e. m. f., current, power and exciting current taken by point-by-point method for different loads. E. m. f. characteristic of carbon arc.

Discussion, incorporated with that of paper by Thorburn Reid on "A New Method of Analyzing the Magnetic Reactions of Armatures Applied to the Stanley Arc-Light Alternating Current Machine."

EXPERIMENTS WITH ALTERNATE CURRENTS OF VERY HIGH FREQUENCY AND THEIR APPLICATION TO METHODS OF ARTIFICIAL ILLUMINATION

Nikola Tesla Vol. viii—1891, pp. 267-319

General discourse on the nature of electricity. Notes on the design and construction of very high frequency generators. Account of experiments with very high frequency and high potential currents, demonstrating the character of discharges through air as affected by electrodes, frequency, potential and various other conditions. Proposal to produce electrostatically incandescent illumination that has the same efficiency and the same economical characteristics of the usual incandescent lamp. The different types of discharge, the lamps and generator are fully illustrated.

No discussion.

SOME RESULTS WITH SECONDARY BATTERIES IN TRAIN LIGHTING

Alexander S. Brown Vol. iv—1889, pp. 205-210

Brief account of experience of the Pennsylvania R. R. with Faure, Brush, Electric Accumulator Co. and Julien Electric Company batteries.

Discussion, pp. 210-216, by Messrs. George B. Prescott, Jr., C. O. Mailloux, Alex. S. Brown, William H. Pierce, Edward L. Nichols and W. B. Vansize.

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A NEW METHOD FOR THE CONTROL OF ELECTRIC ENERGY

D. McFarlan Moore Vol. x—1893, pp. 437-451

Study of action of varying-in-pressure contact to control the current in a circuit so as to permit the operation of a low-voltage lamp on a high-voltage direct-current circuit. Use of same principle for direct production of light in a vacuum surrounding the variable pressure contact. The fore-runner of the Moore tube lamp.

Discussion, pp. 452-463, by Messrs. Laurence J. Zimmerman, Charles Cuttriss, D. McFarlan Moore, Edward P. Thompson, T. D. Lockwood, W. J. Hammer, P. B. Delany, Charles P. Steinmetz, Gano S. Dunn, A. E. Kennelly, E. J. Houston and William E. Geyer.

Criticism of author's theory. General remarks on stability of performance of vibrating contacts carrying current.

ON THE EFFECT OF HEAVY GASES IN THE CHAMBER OF AN INCANDESCENT LAMP

William A. Anthony Vol. xi—1894, pp. 133-149

Account of an experimental investigation of the performance characteristics of lamps filled with vapor of bromine. Analytical study of the cause of blackening and explanation of the effect of gas in lessening blackening.

Discussion, pp. 150-158, by Messrs. Wm. Lispenard Robb, Elihu Thomson, Edward P. Thompson, John W. Howell, W. J. Hammer, S. E. Doane, Theo. J. W. Olan, E. A. Colby, Dr. L. K. Böhm, Otto A. Moses, William A. Anthony, D. McFarlan Moore, R. A. Fessenden, Charles J. Reed, Wilbur M. Stine, B. J. Arnold, Ludwig Gutmann, Mr. Kammer and Dougald C. Jackson.

General discussion of theories of blackening. Experience and experiments with gases and vapors in incandescent lamps.

ON THE SUBDIVISION AND DISTRIBUTION OF ARTIFICIAL SOURCES OF ILLUMINATION

William A. Anthony Vol. xi—1894, pp. 285-291

Illumination from distributed sources compared with that from clusters on the basis of minimum intensity. Incandescent vs. arc lamps for street lighting.

Discussion, pp. 292-301, by Messrs. Nelson W. Perry, Wm. A. Anthony, E. J. Houston, A. E. Kennelly, C. P. Steinmetz, Clayton W. Pike, Francis R. Upton, R. O. Heinrich and W. J. Hammer.

General remarks on candle-power and light distribution from arc lamps. Description of Weber photometer.

SERIES ARC LIGHTING FROM CONSTANT CURRENT TRANSFORMERS

William Lispenard Robb Vol. xvi—1899, pp. 533-540

Description of constant current transformer installation in Hartford, Conn. Results of performance tests.

Discussion, pp. 541-596, by Messrs. C. P. Steinmetz, J. H. Hallberg, Robert Fleming, C. O. Mailloux, W. L. Robb and H. H. Wait.

General remarks on alternating versus direct enclosed arc lamps. Comparative costs and cost of operation of various methods of arc lighting.

C. LAMPS

NOTES ON THE PHENOMENA IN INCANDESCENT LAMPS

Edwin J. Houston Vol. i—1884, pp. 1-5, paper No. 2

Description of electrical conduction through vacuum in an incandescent lamp between the incandescent carbon filament and a platinum electrode.

Discussion, pp. 5-8, by Messrs. N. S. Keith, Edwin J. Houston, William H. Preece and James Kelly.

Remarks on flow of electricity.

CHEMISTRY OF THE CARBON FILAMENT

Edw. P. Thompson Vol. i—1884, pp. 1-11, paper No. 10

Brief description of the chemistry of carbon filament manufacture and short description of the Swan, Stanley, Thompson and Weston processes of carbon filament manufacture.

Discussion, pp. 11-13, by Messrs. W. D. Sargent, Wm. H. Preece, N. S. Keith, John Kelly ——— and Chas. Stagl.

THE ELECTRICAL ARC LAMP FRICTIONAL CLUTCH

Edwin P. Thompson Vol. ii—1885, pp. 1-6, paper No. 4

General remarks on friction clutches and brief descriptions of ring clutch and Wetmore coil spring clutch.

Discussion, pp. 6-12, by Messrs. E. P. Thompson, S. F. Shelbourne, J. F. Kelly, E. P. Roberts, W. A. Anthony, ——— Wetmore, Frankland Jannus, Geo. A. Hamilton, H. B. Slater and F. L. Pope.

Action of friction as a function of speed with various materials.

ON THE CHANGE FROM NEGATIVE TO POSITIVE OF THE TEMPERATURE COEFFICIENT OF SOME CARBON FILAMENTS

W. A. Anthony Vol. iv—1887, pp. 198-199

Brief reference to some experiments which indicate a change of sign of the coefficient of resistivity of carbon filaments.

Discussion, pp. 199-200, by Mr. Elihu Thomson,

Observations which tend to substantiate Professor Anthony's conclusion.

THE MAXIMUM EFFICIENCY OF INCANDESCENT LAMPS

John W. Howell Vol. v.—1888, pp. 237-250

Establishment of relations between specific consumption and life, and investigation of the total cost of operation of lamps at different specific consumptions, with a given cost of energy and price of lamps. Directions for choosing the specific consumption under given conditions, so as to get minimum total cost.

Discussion, pp. 250-262, by Messrs. S. S. Wheeler, Jno. W. Howell, Townsend Wolcott, Jos. Wetzler, Charles Wirt, F. B. Crocker, E. T. Birdsall, C. O. Mailloux, F. R. Upton, Franklin L. Pope and C. J. Field.

General remarks on the economic life of incandescent lamps. Experience with 2.5 watts per candle carbon lamps.

THE EFFICIENCY OF METHODS OF ARTIFICIAL ILLUMINATION

Edward L. Nichols Vol. vi—1889, pp. 158-189

Experimental and analytical study of the energy efficiency of incandescent and arc lamps. Description of methods of measuring the total energy of radiation and the luminous energy of radiation, as well as the distribution of luminosity in the spectrum with the spectro-photometer. Tables of energy efficiency of various illuminants. Luminosity of different colored lights and distribution of luminosity in spectrum from incandescent lamps operated at various degrees of incandescence.

Discussion, pp. 190-202, by Messrs. F. R. Upton, Otto A. Moses, Edward L. Nichols, Joseph Wetzler, C. O. Mailloux, S. S. Wheeler, Robert S. Dobbie, E. T. Birdsall and T. C. Martin.

General remarks on measurement of illumination value of illuminants.

THE RELATION BETWEEN THE INITIAL AND AVERAGE EFFICIENCY OF INCANDESCENT ELECTRIC LAMPS

William H. Peirce Vol. vi—1889, pp. 293-306

Description of incandescent lamp test made for Chicago, Burlington & Quincy R. R. Co., covering calibration of instruments and making of tests. Results plotted as curves, showing relation of specific consumption and candle-power to active life, and also relation of average specific consumption to initial specific consumption.

Discussion, p. 307, by Messrs. E. L. Nichols and William H. Peirce.

THE EFFICIENCY OF THE ARC LAMP

Hastune Nakano Vol. vi—1889, pp. 308-317

Experimental study of the energy efficiency of the arc lamp. The angular distribution of total and luminous radiation. The effect of arc electrode diameter on efficiency.

Discussion, pp. 318-321, by Messrs. George B. Prescott, Jr., E. L. Nichols, M. M. Garver, Elihu Thomson, Edward Weston, William E. Geyer and Otto A. Moses.

General remarks on efficiency of arc lamps.

FORM AND EFFICIENCY OF INCANDESCENT FILAMENTS

Charles J. Reed Vol. vi—1889, pp. 491-502

Development of formulas for expressing the specific consumption in terms of the dimensions of the filament and the constants of the circuit. Relation of specific consumption to the dimensions and form of the filament as determined by these equations. Method of checking the formulas explained with examples.

Discussion, pp. 502-505, by Messrs. E. L. Nichols, George E. Prescott, Jr., Charles J. Reed and T. C. Martin.

Method of measuring temperature differences with Rumford shadow photometer.

LIFE AND EFFICIENCY OF ARC LIGHT CARBONS

Louis B. Marks Vol. vii—1890, pp. 175-202

Experimental investigation of the structure, life, volt-ampere characteristics, specific consumption and candle-power distribution of different types of American arc lamp carbon electrodes.

Discussion, pp. 245-256, by Messrs. W. G. Blodgett, Elihu Thomson, Louis Marks, O. T. Crosby, W. A. Anthony and Franklin L. Pope.

Additional data on the characteristic performance of electric lamp carbon electrode.

A PHOTOGRAPHIC STUDY OF THE ELECTRIC ARC

Edward L. Nichols Vol. viii—1891, pp. 214-221

Account of experiments that show the intermittent character of alternating current arc and explaining the cause of surging. Measuring wave form and photographs of arc observed with revolving mirror under various conditions.

Discussion, pp. 222-226, by Messrs. Elihu Thomson, Edward L. Nichols, Carl Hering, C. O. Mailloux and Thos. D. Lockwood.

Explanation of cause of wave distortion by arc. Beginning of custom of presenting the Institute with portraits of past Presidents.

A LIFE AND EFFICIENCY TEST OF INCANDESCENT LAMPS

B. F. Thomas, P. Martin and R. H. Hassler Vol. ix—1892, pp. 271-288

Account of life tests on different types of carbon filament lamps. Candle-power, specific consumption and current time curves.

Discussion, pp. 289-290, by Messrs. Carl Hering and Prof. Roberts.

Comparative test of lamps.

THE MOST ECONOMICAL AGE OF INCANDESCENT LAMPS

Carl Hering Vol. x—1893, pp. 65-74

Analysis of the total cost per candle hour of light from incandescent lamps of various prices at different stages of their lives, giving curves plotted between life and cost of candle hours.

Discussion, pp. 74-84, by Messrs. B. F. Thomas, Elihu Thomson, E. P. Roberts, W. D. Weaver, Carl Hering, George Hill, Townsend Wolcott, W. J. Hammer and W. D. Lockwood.

Formula for smashing point.

RECENT DEVELOPMENTS IN VACUUM TUBE LIGHTING

D. McFarlan Moore Vol. xiii—1896, pp. 85-108

Description of investigations of vacuum tube lighting by discharges of electric energy from a vibrating interrupter in a vacuum.

Discussion, pp. 108-124, by Messrs. C. P. Steinmetz, J. P. Wintringham, L. M. Pinolet, W. A. Anthony, N. W. Perry, Townsend Wolcott, Louis Duncan, Carl Hering, A. E. Kennelly, E. E. Ries, E. L. Nichols, J. W. Howell, D. McFarlan Moore, Joseph Wetzler and S. S. Wheeler.

Criticisms of the author's methods and system. Results of tests on Moore lighting system.

CONDUCTIVITY OF INCANDESCENT CARBON FILAMENTS, AND OF THE SPACE SURROUNDING THEM

John W. Howell Vol. xiv—1897, pp. 27-42

Experimental investigation of Edison effect in specially constructed lamps.

Discussion, pp. 42-53, by Messrs. John W. Howell, Louis Duncan, A. E. Kennelly, E. A. Colby, Samuel Sheldon, R. W. Pope, Douglass Burnett, Townsend Wolcott, Charles Wirt and W. M. Stine.

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THE ENCLOSED ARC LAMP

Wm. H. Freedman, H. S. Burroughs and J. Rapaport Vol. xiv—1897, pp. 423-448

Construction of enclosed arc lamp mechanism. Performance tests of photometric curves, showing the effect of different types of glassware upon the intensity of distribution curves.

Discussion, pp. 449-456, by Messrs. F. B. Crocker, A. E. Kennelly, R. E. Owens, L. B. Marks, H. C. Spaulding, C. P. Steinmetz and C. T. Rittenhouse

19. ELECTRICITY IN THE ARMY AND NAVY

ELECTRICITY IN THE NAVY

Gilbert Wilkes **Vol. vii—1890, pp. 155-160**

Ideal requirements for a marine generator. Naval practice as to type, voltage, power capacity, etc., of the generator unit.

Discussion, pp. 160-162, by Messrs. Otto A. Moses, Gilbert Wilkes, Townsend Wolcott, R. N. Bayles, E. T. Birdsall and Robert S. Dobbie.

Effect of electric plant upon compass.

ELECTRICITY ON BOARD SHIP

S. Dana Greene **Vol. xvi—1899, pp. 3-17**

General outline of the power requirements on board modern first-class battleships. Comparison of the relative merits of different types of motive power. Results from tests giving the steam consumption of main and auxiliary machinery on U. S. S. Minneapolis.

Discussion, pp. 18-42, by Messrs. J. W. Lieb, Jr., T. C. Martin, H. Ward Leonard, Elihu Thomson, Townsend Wolcott, Lieut. Walling, John Millis, H. L. Holbrow, Joseph Bijur, S. Dana Greene and George Hill.

Ward Leonard system of gun motor control for gun turrets. Thomson's high efficiency single-stroke engine. General remarks on the use of electricity in the Navy.

20. MISCELLANEOUS APPLICATIONS OF ELECTRICITY

A. ELECTROCHEMISTRY AND METALLURGY

DEPOSITING VATS IN "SERIES"

H. B. Slater Vol. i—1884, pp. 1-4, paper No. 11

Description of practical experience in modification of electroplating vats, so as to double useful output of given generator.

Discussion, pp. 4-7, by Messrs. H. B. Slater, W. D. Sargent, N. S. Keith, E. A. Sperry and Jas. Kelly.

General remarks on methods of connecting electrolytic vats.

AUTOMATIC ELECTRIC WELDING MACHINES

Hermann Lemp, Jr. Vol. vii—1890, pp. 288-303

Requirements of repeat welding processes. Mode of operating Thomson welders. Methods of regulating the e. m. f. and current. Design of welding transformers.

No discussion.

ELECTRICITY IN THE PRODUCTION OF ALUMINIUM

Alexander S. Brown Vol. viii—1891, pp. 131-146

Brief résumé of the history of the development of commercial processes of manufacturing aluminium, with short description of Hall, Cowles and Heroult processes and of the Oerlikon dynamos used in the Heroult process at Boonville, N. J.

Discussion, pp. 147-157, by Messrs. M. G. Farmer, Francis B. Crocker, F. L. Pope, E. T. Birdsall, Alexander S. Brown, Townsend Wolcott and Albert Stetson.

Historical notes on the development of aluminium processes. Estimate of actual cost of production of aluminium. Mechanical and chemical properties of aluminium. Solder flux for aluminium.

THE PRACTICAL ASPECTS OF ELECTRIC WELDING

Frederic A. C. Perrine Vol. viii—1891, pp. 246-257

Brief sketch of the representative uses of electric welding processes, as exemplified in various actual installations, followed by short discussion of limitations and difficulties of the process.

Discussion, pp. 257-265, by Messrs. Elihu Thomson, W. J. Hammer, W. M. Maver, Jr., and Thos. D. Lockwood.

General remarks on characteristics of electric welding processes. Methods of avoiding difficulties with certain metals. Working and cutting of glass with electric heat.

THE FUTURE OF THE ALUMINIUM PROBLEM FROM THE CHEMICAL STANDPOINT

William H. Wahl Vol. viii—1891, pp. 396-412

Analytical discussion of the metallurgical methods of reducing aluminium, with special reference to the case as compared with electric processes.

Discussion, pp. 412-419, by Messrs. Elihu Thomson, Thos. D. Lockwood, William H. Wahl, P. H. Vander Weyde, ——— Waldo, Edw. Weston and Oberlin Smith.

General remarks on the properties of aluminium and some of its alloys.

PRACTICAL NOTES ON THE ELECTROLYTIC REFINING OF COPPER

F. B. Badt Vol. ix—1892, pp. 508-524

Description of American practice in electrolytic refining of copper, based on patents and experience.

No discussion.

LOCAL ANNEALING OF HARD FACED ARMOR PLATES

Herman Lemp, Jr. Vol. xii—1895, pp. 529-540

Description of method of annealing surface hardened plates with Thomson welding apparatus. Photographs of the apparatus.

Discussion, pp. 540-545 and 576-577, by Messrs. F. B. Crocker, E. P. Thompson, A. E. Kennelly, Herman Lemp, Jr., E. A. Pattison, W. W. Ker, Nelson W. Perry, Townsend Wolcott, A. V. Abbott and Samuel Rodman, Jr.

B. MINING

ELECTRICITY IN BITUMINOUS MINING

Elmer A. Sperry Vol. ix—1892, pp. 375-400

Brief résumé of the early mechanical methods of working mines. Description of electric drills, cutters, hoisting machinery and locomotives for use in coal mining.

Discussion, pp. 400-406, by Messrs. Frank J. Sprague, C. E. Emery, N. W. Perry, E. A. Sperry and H. Ward Leonard.

Experience with mining locomotives.

NOTES ON ELECTRICITY IN MINING WORK

Sydney F. Walker Vol. viii—1891, pp. 431-446

General discussion of English practice with reference to the installation of signals, shot firing appliances, telephones, lighting systems, electric pumping and haulage systems.

Discussion, pp. 446-450, by Messrs. Hollon C. Spaulding and H. Ward Leonard.

Sharp criticisms of the practice outlined in the paper.

THE ELECTRIC PERCUSSION DRILL IN THEORY AND PRACTICE

Harry N. Marvin Vol. ix—1892, pp. 407-422

Description of the development and construction of reciprocating electro-magnetic drill.

Discussion, pp. 422-424, by Messrs. E. A. Sperry, H. N. Marvin and C. S. Bradley.

ELECTRICITY IN COAL MINING

John P. Jackson and Frank P. Thompson Vol. xvi—1899, pp. 449-457

Uses for energy in soft coal mining. Examples of mines operated by steam, compressed air and electricity. Brief discussion of experience in electric mine haulage, coal cutting and pump operation.

Discussion, pp. 457-459, by Messrs. E. A. Sperry, W. S. Aldrich and A. D. Adams.

Coal mining plant operated by electricity.

C. INDUSTRIAL POWER

ELECTRIC POWER IN FACTORIES AND MILLS

F. B. Crocker, V. M. Benedikt and A. F. Ormsbee Vol. xii—1895, pp. 298-310

Report of tests made to determine power required to drive different types of machine tools. General description of typical cotton mill electric installation. Outline of advantages of electric drive.

Discussion, pp. 311-325, by Messrs. C. E. Emery, H. Ward Leonard, Gano S. Dunn, Geo. W. Blodgett, C. R. Van Trump, Harry Alexander, S. S. Wheeler and William Brophy.

General discussion of the advantages of electric motor drive. Experience with factory installation.

THE LIMITATIONS OF POWER SUBDIVISION BY ELECTRIC MOTORS IN MANUFACTURING ESTABLISHMENTS

Vol. xvi—1899, pp. 145-181

Topical discussion of motor drive for factories and shops. Group versus individual arrangement of machines.

Discussion, by Messrs. Gano S. Dunn, R. T. E. Lozier, F. M. Pederson, George Hill, H. B. Coho, Oberlin Smith, Townsend Wolcott, James Hamblet, H. Ward Leonard, Douglass Burnett, Arthur Williams, James M. Smith and A. E. Kennelly.

D. MEDICINE

A BRIEF GLANCE AT ELECTRICITY IN MEDICINE

W. J. Morton Vol. x—1893, pp. 555-602

Résumé of practice of electrotherapeutics, covering the healing properties of electrical energy in various forms: continuous current, pulsating current, alternating current, high and low frequency currents, high and low potential high frequency currents. Description of apparatus and methods of treatment.

No discussion.

DISCUSSION OF SURGICAL VALUE OF RONTGEN RAY

James Burry Vol. xiii—1896, pp. 79-82

Discussion by Prof. W. M. Stine.

E. MISCELLANEOUS

PRESIDENT'S ADDRESS

Vol. iv—1887, pp. 122-128

Brief statistical outline of electrical industry.

THE ABDANK MAGNETIC CALL AND THE ABDANK INTEGRAPH

B. Abdank-Abakanowicz Vol. vi—1889, pp. 13-17

Description of electro-magnetic generator for call bell, and analysis of wave form of its e. m. f. Brief description of integraph.

Discussion, pp. 17-24, by Messrs. William E. Geyer, B. Abdank, Townsend Wolcott, Carl Hering, Alfred M. Mayer, Elihu Thomson, H. P. Vander Weyde, C. O. Mailloux and T. C. Martin.

Description of melograph and melotrope-electric piano player.

THE IMPROVED GRAMAPHONE

Emile Berliner Vol. viii—1891, pp. 19-29

Account of early developments in the art of sound reproduction. Description of the Berliner flat disk gramaphone. Its underlying principles and advantages.

No discussion.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND

H. Ward Leonard Vol. xii—1895, pp. 36-53

Account of observations of European practice in manufacturing and engineering, synchronous converters, steam engines, Parsons and DeLaval turbines, electric railways, central stations. Description of equipment and mode of operating and tests of Heilman self-contained electric locomotive.

Discussion, pp. 54-77, by Messrs. Townsend Wolcott, John W. Lieb, Jr., Chas. E. Emery, Herbert Lloyd, A. E. Kennelly, Wm. Maver, Jr., M. N. Forney, Cary T. Hutchinson, W. L. Bliss, Richard Fleming, Joseph Sachs, F. B. Crocker, E. J. Houston, H. Ward Leonard, B. J. Arnold, W. M. Stine, C. K. MacFadden, L. L. Summers and A. V. Abbott.

General data on Berlin central stations. Discussion of the Heilman locomotive performance and probable usefulness.

ELECTRIC ELEVATORS WITH DETAILED DESCRIPTION OF SPECIAL TYPES

Frank J. Sprague Vol. xii—1896, pp. 3-22

Comparison of electric with hydraulic elevators. Detailed description of Sprague-Pratt multiple screw elevator.

Discussion, pp. 23-33 and 37-67, by Messrs. C. P. Steinmetz, Cary T. Hutchinson, James Hamblet, George Hill, Frank J. Sprague, Charles E. Emery, H. Ward Leonard, C. O. Mailloux, F. S. Holmes, F. B. Crocker,

R. H. Pierce, Frank B. Rae, B. J. Arnold, W. M. Stine, S. G. Meiler, J. F. Stevens, Albert Scheible, J. W. Lieb, Jr., and John D. Ihlder.

Comparison of electric and hydraulic elevators as to operation and maintenance. Test of electric elevator plants and heating required in various buildings. Economics of application of storage battery to elevator plant.

THE RONTGEN RAY, AND ITS RELATION TO PHYSICS

Vol. xiii—1896, pp. 403-441

Topical discussion, by Messrs. Henry A. Rowland, Elihu Thomson, M. I. Pupin, A. E. Kennelly, Max Osterberg, Louis Duncan, W. M. Stine, C. O. Mailloux and C. T. Rittenhouse.

General remarks on the theory and properties of Röntgen rays. Brief history of development of knowledge of the Röntgen ray.

THE ECONOMY AND UTILITY OF ELECTRICAL COOKING APPARATUS

John P. Jackson Vol. xiv—1897, pp. 481-486

Results of tests upon the energy consumption and cost of cooking with electric energy.

Discussion, pp. 487-488, by Messrs. Elihu Thomson, R. B. Owens and C. P. Steinmetz.

21. TELEPHONY AND TELEGRAPHY

A. GENERAL THEORY

THE INDUSTRIAL UTILIZATION OF THE COUNTER-ELECTROMOTIVE FORCE OF SELF INDUCTION

Thomas D. Lockwood Vol. vii—1890, pp. 226-243

Outline of discovery and development of the use of counter e. m. f. of self-inductance. Citing reference to original articles and patents covering applications of counter e. m. f. of inductance in telephone, telegraph and lighting circuits.

No discussion.

B. TELEPHONE SYSTEMS.

SOME RECENT ADVANCES IN TELEPHONY

Thomas D. Lockwood Vol. iii—1886, pp. 74-87

Brief history of the development of telephony, with special reference to improvements that bear on long distance work. Some important dates in telephone history. Description of Lockwood parallel wire method of neutralizing inductive disturbances.

Discussion, pp. 87-93, by Messrs. Thomas D. Lockwood, Frank L. Pope, Ralph W. Pope, Sidney F. Shelbourne and F. W. Jones.

Experience with induction repeaters.

UNDERGROUND ELECTRICAL CONDUCTORS IN EUROPE AND AMERICA

G. W. Plympton Vol. v—1888, pp. 328-335

General review of the practice in Europe and America as to type of telephone distribution system employed. Practical limit of telephone transmission distance through cables.

Discussion, pp. 335-338, by Messrs. J. A. Powers, G. W. Plympton and C. O. Mailloux.

INDUCTIVE DISTURBANCES IN TELEPHONE CIRCUITS

J. J. Carty Vol. viii—1891, pp. 99-108

Account of experiments with telephone circuits, tending to establish the hypothesis that electro-magnetic disturbances are negligible in comparison with electrostatic disturbances originating in parallel telephone circuits. Factors which determine the frequency of transposition necessary to obtain silence.

Discussion, pp. 109-126, by Messrs. Thomas D. Lockwood, A. E. Kennelly, J. J. Carty, W. A. Anthony, Geo. B. Prescott, Jr., Louis Bell, W. M. Miner, H. Franklin Watts, Frank B. Crocker, Francis R. Upton and Ralph W. Pope.

General remarks on the causes of disturbing currents in telephone circuits.

Relative magnitude of electro-magnetic and electrostatic disturbances.

SELECTIVE OR INDIVIDUAL SIGNALS

Thomas D. Lockwood Vol. ix—1892, pp. 527-544

Historical sketch of the development of selective signalling, followed by description of various systems as revealed by United States patents.

Discussion, pp. 544-546, by Messrs. F. B. Crocker, Thomas D. Lockwood, F. R. Upton and T. C. Martin.

THE EVOLUTION OF THE LINE SIGNAL

Arthur Vaughn Abbott Vol. xv—1898, pp. 425-442

Description of the development of telephone switchboard line signals, leading up to a single lamp and relay developed by the author and Mr. M. A. Edson, which is described in detail. Data on the life and candlepower characteristics of low voltage lamps compared with similar characteristics obtained several years ago, thus showing the progress in the art of low voltage incandescent lamp design.

No discussion.

SOME TELEPHONE DISTURBANCES FROM ELECTRICAL GENERATORS

George D. Shepardson Vol. xv—1898, pp. 443-460

Account of qualitative investigation of telephone disturbances caused by direct commutation in neighboring systems. Bibliography of telephone line disturbances from other circuits.

No discussion.

C. TELEGRAPH SYSTEMS

SYNCHRONISM

Edwin J. Houston Vol. i—1884, pp. 1-7, paper No. 4

Description of Delany's synchronizer for telegraph work and account of results obtained with it.

Discussion, pp. 7-11, by Messrs. E. J. Houston, W. D. Sargent, P. B. Delany, C. O. Mailloux, C. J. Kintner and G. C. Maynard.

Further explanation of the mode of operation of the synchronizer.

THE DELANY SYNCHRONOUS MULTI-PLEX SYSTEM OF TELEGRAPHY

Edwin J. Houston Vol. i—1884, pp. 1-19, paper No. 5

Description of the advantages, construction and mode of operation of the Delany synchronous telegraph system. Constructional drawings and circuit diagrams.

EARTH WIRES; OR, THE EARTH AS AN ELECTRIC CIRCUIT COMPLETER

Thos. D. Lockwood Vol. i—1884, pp. 1-8, paper No. 8

Account of earliest uses of earth as return conductor and the first application of the earth as common return in telegraph systems. Brief statement of electric conductor theories of earth return. Description of methods of making various kinds of ground connections in telegraph work.

DELANY'S SYSTEM OF FACSIMILE TELEGRAPH

Edwin J. Houston Vol. ii—1885, pp. 1-18, paper No. 6

Reference to early work in facsimile telegraphy. Detailed description with constructional drawings of the Delany apparatus.

STATIC DIFFICULTIES IN TELEGRAPH WIRES

F. W. Jones Vol. iii—1886, pp. 111-127

Compilation of extracts from English and United States Patents on the subject of neutralizing electrostatic disturbances in telegraph transmission.

Discussion, pp. 127-128, by Messrs. Frank L. Pope and Ralph W. Pope.

RECENT IMPROVEMENTS IN APPARATUS FOR OCEAN CABLING

Charles Cuttriss Vol. v—1888, pp. 69-83

Account of the development of the Cuttriss siphon recorder for Thomson's siphon recorder, with detailed description of both instruments. Description of the Allen & Brown relay for Morse working of cables.

Discussion, pp. 83-96, by Messrs. Jos. Wetzler, Charles Cuttriss, T. C. Martin, Captain Trott, S. S. Wheeler, Ralph W. Pope, Geo. G. Ward and F. Bennett.

General remarks on the possibilities of telephony through considerable distances of cable.

A NEW SYSTEM OF MULTIPLEX TELEGRAPHY

F. Jarvis Patten Vol. vi—1889, pp. 111-126

Brief exposition of the underlying principles of multiplex telegraphy. Description of a motor system of synchronizing and method of determining synchronism. Circuit diagrams of multiplex system using these synchronizers.

Discussion, pp. 126-134, by Messrs. C. O. Mailloux, R. W. Pope, P. B. Delany, F. J. Patten, C. J. Kintner, B. C. Batcheller, Francis B. Crocker and E. C. Davidson.

Impulses per second required for Morse transmission. Advantage of Patten system of transmitted synchronism in eliminating time lag. Difference between synchronism and isochronism.

TELEGRAPH LINE ADJUSTMENT

P. B. Delany Vol. vi—1889, pp. 506-513

Brief outline of conditions met in ordinary railroad telegraphy. Description of device for adjusting line in wet weather to permit normal operation in spite of heavy leakage.

Discussion, incorporated with that of paper by P. B. Delany on "Note on a New Gravity Cell."

THE SYNCHRONOGRAPH

Albert C. Crehore and George O. Squier Vol. xiv—1897, pp. 93-129

Development of the principles of a method of employing alternating current in high speed telegraphy, devised by the authors. Description of the apparatus and results of an experimental investigation.

Discussion, pp. 130-154, by Messrs. F. W. Jones, A. E. Kennelly, P. B. Delany and A. C. Crehore.

Brief résumé of history of high speed telegraphy, showing why automatic systems had been a failure. Advantages and possibilities of high speed machine telegraphy.

HISTORICAL SKETCH OF THE FIRE ALARM TELEGRAPH

Adam Bosch Vol. xiv—1897, pp. 335-350

Discussion, pp. 351-352, by Messrs. F. B. Crocker, George F. Barker and Miss Sarah J. Farmer.

AN AMERICAN PACIFIC CABLE

George O. Squier Vol. xvi—1899, pp. 653-674

Account of the various projects that have been advanced for the construction of Pacific cables. Estimated costs of installation, maintenance and operation, and income. Information and data concerning Pacific cable projected by U. S. Coast and Geodetic Survey.

Discussion, pp. 675-687, by Messrs. H. L. Webb, T. E. Hughes, G. O. Squier, A. E. Kennelly, M. I. Pupin and J. H. Hillberg.

General remarks on methods of operation of proposed Pacific cable.

D. WIRELESS SYSTEMS

TELEGRAPHING WITHOUT WIRES—AN EXPERIMENT

S. J. M. Bear Vol. i—1884, pp. 1-3, paper No. 9

Description of experiment in which current impulses are transmitted through water without wires.

Discussion, pp. 3-13, by Messrs. S. J. M. Baer, W. D. Sargent, Jas. Kelly, N. S. Keith, —— Partz, —— Bailey, G. C. Maynard and William H. Preece.

Description of similar experiment tried in 1853 in England.

WIRELESS TELEGRAPHY

Vol. xiv—1897, p. 607

Exhibition of Marconi wireless telegraph apparatus.

Discussion, pp. 608-613, by Messrs. A. E. Kennelly, Gano S. Dunn, W. J. Clarke, Edward Durant, W. H. Macgregor, Samuel Sheldon, C. P. Child and Albon Man.

THE POSSIBILITIES OF WIRELESS TELEGRAPHY

Vol. xvi—1899, pp. 607-651, 690

Topical discussion by Messrs. R. A. Fessenden, W. J. Clark, M I. Pupin, F. V. Henshaw, C. E. Dunn, A. E. Kennelly, C. P. Steinmetz, C. O. Mailloux, A. V. Abbott, G. M. Mayer, Thomas Duncan, James Lyman, V. R. Lansingh and W. S. Franklin.

Description of instruments for measuring electric waves. Experience with Marconi plant used for reporting yacht races. Possibilities of tuning in wireless telegraphy. Evolution of wireless telegraphy and wireless telegraph apparatus.

22. Miscellaneous Topics

A. INSTITUTE AFFAIRS

ANNUAL REPORTS

Vol. ii—1885, pp. 1-26, Paper No. 1

Discussion of Amendments of the Constitution.

Vol. iii—1886, pp. 1-30

Committee appointed to consider the indorsement of Brush wire gauge. Title of Past President introduced.

Vol. vi—1889, pp. 1-2
Vol. vii—1890, pp. 151-152
Vol. viii—1891, pp. 179-182
Vol. ix—1892, pp. 167-174
Vol. x—1893, pp. 233-250
Vol. xi—1894, pp. 247-272
Vol. xii—1895, pp. 215-224
Vol. xiii—1896, pp. 125-127
Vol. xiv—1897, pp. 156-159
Vol. xv—1898, pp. 260-266
Vol. xvi—1899, pp. 186-192
Vol. xvii—1900, pp. 239-245

HISTORICAL PREFACE

Vol. i—1884, pp. 1-4, Paper No. 1

History of the founding of the American Institute of Electrical Engineers. Copy of the circular issued in advocation of the formation of the Institute.

Officers elected at the first meeting.

CONSTITUTION OF THE INSTITUTE

Vol. i—1884, pp. 1-5, Paper No. 13

REPORT OF COMMITTEE ON STANDARD WIRE GAUGE

Vol. iii—1886, pp. 144-157

After discussion, the adoption is postponed.

Report of the Committee on monthly meeting is adopted and steps taken to call a meeting the following month.

FIRST MONTHLY MEETING OF THE INSTITUTE

Vol. iv—1887, pp. 1-6

Outline of plan for generating low potential energy at coal mines and stepping up potential with storage batteries for long distance transmission.

Discussion, pp. 7-25, by Messrs. Joseph Wetzler, Otto A. Moses, ———

Rapieff, T. C. Martin, Sidney F. Shelbourne, Thos. D. Lockwood, C. O. Mailloux and G. W. Mansfield.

Speculative discussion of ways and means of transmitting electric energy at high potentials. Description of Crook's effect and series explaining it.

PRESIDENT ELIHU THOMSON'S TOAST AT BANQUET GIVEN BY LORD MAYOR OF LONDON AT GUILD HALL

Vol. vi—1889, pp. 483-484

PRELIMINARY REPORT OF THE STANDARD WIRING TABLE COMMITTEE

Vol. vii—1890, pp. 344-365

Standard conductivity based on Matthiessen's correct standard. Discussion of Matthiessen's standard. Resolution for the adoption of the henry as a unit of inductance.

REPORT OF THE STANDARD WIRING TABLE COMMITTEE

Vol. vii—1890, pp. 408-411

Discussion, pp. 411-417, by Messrs. F. B. Crocker, J. Stanford Brown, M. I. Pupin, R. W. Pope, C. O. Mailloux, E. T. Birdsall, George B. Prescott, Jr., Thomas D. Lockwood and Thorburn Reid.

Report, received, presented, but its adoption deferred.

REPORT OF COMMITTEE ON UNITS AND STANDARDS

Vol. viii—1891, pp. 533-534

List of new units practically needed for convenience in dealing with magnetic circuits.

Discussion, pp. 535-543, by Messrs. Carl Hering, C. O. Mailloux, Thos. D. Lockwood, A. E. Kennelly, Townsend Wolcott, W. A. Anthony, J. Stanford Brown, M. I. Pupin, Chas. P. Steinmetz and Francis B. Crocker.

REPORT OF DELEGATION TO THE FRANKFORT ELECTRICAL CONGRESS

Vol. viii—1891, pp. 544-547

Account of the presentation of the American Institute of Electrical Engineers' proposition for international definition of the "Henry" as practical unit of inductance.

NOTES ON THE FRANKFORT ELECTRICAL EXHIBITION

Carl Herring

Vol. viii—1891, pp. 549-560

Report on the electrical exhibits and applications of electricity at the Exposition. Study of dynamo designed and electrical distribution as represented at the Exposition.

No discussion.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Vol. viii—1891, pp. 601-60

Historical sketch of its organization and work.

COMING DEVELOPMENT OF ELECTRIC RAILWAYS

Presidential Address

Frank J. Sprague Vol. ix—1892, pp. 229-249

Brief review of current practice of steam roads and possibilities of introduction of electromotive power in these systems.

No discussion.

REPORT OF COMMITTEE ON REVISION OF THE RULES REGARDING THE ELECTION OF OFFICERS

Vol. ix—1892, pp. 460-461

REPORT OF THE SUB-COMMITTEE ON PROVISIONAL PROGRAMME FOR THE INTERNATIONAL ELECTRICAL CONGRESS OF 1893

Vol. x—1893, pp. 1-12

Appendix I.—Brief Summary of the Units, Terms, Symbols and Definitions Adopted by Previous Electrical Congresses.—pp. 13-14.

Appendix II.—List of New Units Practically Needed for Convenience in Dealing with Magnetic Circuits.—pp. 15-16.

Appendix III.—The Silver Voltameter.—pp. 17-20.

Appendix IV.—Electric Notation, Abbreviations and Symbols.—pp. 401-403.

Appendix V.—Matthiessen's Standard of Resistance of Copper.—pp. 21-26.

COMPILATION OF DISCUSSIONS, SUGGESTIONS AND CRITICISMS APPEARING IN THE TECHNICAL AND SCIENTIFIC PRESS UPON THE REPORT AND PROVISIONAL CONGRESS PROGRAMME OF THE SUB-COMMITTEE APPOINTED BY THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Vol. x—1893, pp. 404-426

ON THE NOTATION PROPOSED BY M. HOSPITALIER

Alexander Macfarlane Vol. x—1893, pp. 427-429

COMMENTS ON THE REPORT OF THE COMMITTEE ON THE PROVISIONAL PROGRAMME FOR THE CONGRESS

John Sahulka Vol. x—1893, pp. 430-432

THE INTERNATIONAL ELECTRICAL CONGRESS AND WORLD'S FAIR, OF 1893

President's Address

Edwin J. Houston Vol. x—1893, pp. 464-478

Report of the delegates of the International Electrical Congress. Criticism of the management of the Congress.

Discussion, pp. 479-483, by Messrs. T. D. Lockwood, W. H. Preece, F. W. Jones, Charles P. Steinmetz and W. J. Hammer.

General remarks on the Congress.

MONTHLY MEETINGS OF THE INSTITUTE, THEIR ORIGIN AND PROPOSED DEVELOPMENT

Ralph W. Pope — Vol. x—1893, pp. 528-543

Presentation of the plan for the establishment of local branches for the Institute.

Discussion, pp. 544-554, by Messrs. Dr. C. A. Doremus, A. J. Bloor, George Hill, Charles P. Steinmetz, F. A. Bowman, A. E. Kennelly, Charles E. Emery and H. L. Webb.

Letters from men prominent in other societies that have local branches. Outline of resolution to authorize establishment of local branches.

REPORT OF COMMITTEE ON LOCAL MEETINGS

Vol. x—1893, pp. 603-626

Discussion by Messrs. Townsend Wolcott, James Hamblet, Ralph W. Pope, H. L. Webb, George M. Phelps, E. J. Houston, Chas. Cuttriss, T. C. Martin, W. J. Hammer, Charles E. Emery, A. E. Kennelly, R. O. Heinrich, W. B. Vansize, Francis B. Crocker and Nelson W. Perry.

INSTITUTE WIRE TABLE

Vol. x—1893, pp. 668

REPORT OF COMMITTEE ON UNITS AND STANDARDS

Vol. xi—1894, pp. 48-52

Discussion, by Messrs. Townsend Wolcott, C. O. Mailloux, Charles P. Steinmetz, A. E. Kennelly and C. S. Bradley.

REPORT OF COMMITTEE ON REVISION OF RULES

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REPORT OF COMMITTEE ON UNITS AND STANDARDS

Vol. xi—1894, pp. 124-132

ANNUAL REPORTS OF THE COUNCIL, SECRETARY AND TREASURER. ALSO THE COMMITTEE ON UNITS AND STANDARDS AND THE COMMITTEE ON REVISION OF RULES

Vol. xi—1894, pp. 246-274

A REVIEW OF THE PROGRESS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

President's Address

Edwin J. Houston — Vol. xi—1894, 275-284

SUGGESTIONS FOR AN INDEX OF ENGINEERING LITERATURE

George D. Shepardson — Vol. xi—1894, pp. 789-795

General discussion of the importance of indexing engineering literature. Outline of various important indices. Suggested plan for engineering index.

Discussion, pp. 796-826, by Messrs. T. C. Martin, J. S. Brown, W. E. Goldsborough, Max Osterberg, Carl Hering, F. B. Crocker, Edward Caldwell, R. W. Pope, E. J. Houston, W. S. Aldrich, C. Wellman Parks, Fred. DeLand, W. M. Stine and L. L. Summers.

General remarks on the classification of engineering topics and the making of indices.

REPORT OF THE COMMITTEE ON UNITS AND STANDARDS

Vol. xi—1894, pp. 827-829

MOTION TO INCORPORATE THE INSTITUTE

Vol. xiii—1896, pp. 35-36

THE PRECISION OF ELECTRICAL ENGINEERING

Presidential Address

F. B. Crocker Vol. xiv—1897, pp. 237-249

Part played by precision measurement and determination of electrical quantities in the department of electrical engineering.

THE INTERNATIONAL ELECTRICAL CODE

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Report of the International Electrical Code, 514.

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THE PATENT OFFICE—ITS RELATION TO INVENTORS AND ITS NEEDS

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Beginning of U. S. Patent Office; its original and present organization. Classification of the staff and description of the duties of each branch. Detailed account of the present status and needs of the Patent Office.

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General discussion of the shortcomings of the Patent Office.

THE PROTECTION OF ELECTRICAL INVENTIONS

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General remarks on U. S. Patent system. Citation of specific cases which illustrate what a patent should contain.

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Recital of experiences with the U. S. Patent Office system. Motion made and passed to appoint committee to call attention of Congress to the needs of the Patent Office.

THE PATENT OFFICE AND PATENT OFFICE PRACTICE

A. C. Fowler

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General discussion of reforms needed in the United States Patent Office, followed by discourse on some important features in Patent Office practice. General instructions for drawing up patent specifications.

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Arthur Steuart

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General discussion of the U. S. Patent office situation and arguments for and against changes; praise and criticism of the system.

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Rowland R. Hazard

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Patrick B. Delany

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Additional information on the methods of construction employed in English distribution systems. Electric railways in England.

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Franklin L. Pope

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